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Ready September 1937

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Professor of Mechanical Engineering, University of Illinois

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ohn Wiley & Sons, Inc., 440 Fourth Avenue, New York

Cambridge Meeting—June 28–July 2, 1937

Hosts: Massachusetts Institute of Technology and Harvard University

1927 1937

TEN YEARS AGO THIS OCTOBER

It is interesting to turn back the pages of the years and read the record of a business. For time has a way of testing purposes and policies. The fundamental policy of the Bell System is not of recent birth—it has been the corner-stone of the institution for many years. On October 20, 1927, it was reaffirmed in these words by Walter S. Gifford, Pres., American Telephone and Telegraph Co.

"The business of the American Telephone and Telegraph Company and its Associated Bell Telephone Companies is to furnish telephone service to the nation. This business from its very nature is carried on without competition in the usual sense.

"These facts have a most important bearing on the policy that must be followed by the management if it lives up to its responsibilities.

"The fact that ownership is so widespread and diffused imposes an unusual obligation on the management to see to it that the savings of these hundreds of thousands of people are secure and remain so.

"The fact that the responsibility for such a large part of the telephone service of the country rests solely upon this Company and its Associated Companies also imposes on the management an unusual obligation to the public to see that the service shall at all times be adequate, dependable and satisfactory to the user.

"Obviously, the only sound policy that will meet these obligations is to continue to furnish the best possible telephone service at the lowest cost consistent with financial safety. This policy is bound to succeed in the long run and there is no justification for acting other than for the long run.

"Earnings must be sufficient to assure the best possible telephone service at all times and to assure the continued financial integrity of the business. Earnings that are less than adequate must result in telephone service that is something less than the best possible.

"Earnings in excess of these requirements must either be spent for the enlargement and improvement of the service furnished or the rates charged for the service must be reduced. This is fundamental in the policy of the management."

BELL TELEPHONE SYSTEM

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TABLE OF CONTENTS

Program of 45th Annual Meeting 627
The Cambridge Meeting of 1937. President H. P. Hammond 659
New England—Vacationland. Chester L. Dawes 662
Teaching of Basic Courses. H. S. Rogers 672
Enduring Values in Engineering Education. Gilbert E. Doan 680
What Training in Graphics Does Industry Require of the Young Engineer?
A. S. Levens 686
Is Invention Stimulated by Electrical Engineering Training? A. G. Conrad 692
Report of Conference on Mechanics 699
Meeting of Applied Mechanics and Hydraulics Division, A. S. M. E. 703
Sections and Branches:
Illinois-Indiana 704
Lafayette 707
Michigan 707
Newark College of Engineering 709
Ohio 710
Pacific Northwest 710
Southeastern 711
Tufts College 712
College Notes 714
New Members 716
Engineering Economy Page 717
T-Square Page 718
English Notes 719
Necrology: Dudley Peak Craig 720
O. P. Hood 720
Book Reviews 722

HEADQUARTERS OF THE SOCIETY

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THE FORTY-FIFTH ANNUAL MEETING SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION

TIME ARRANGEMENT OF THE MEETING AND CONFERENCES

Friday, June 18–Saturday, June 26

All-day sessions, Stevens Institute of Technology Engineering Camp, Johnsonburg, N. J.

Economics in Engineering Colleges and the Place of Economics in the Engineering Curricula

Monday, June 28

Morning	Summer Conference: Mechanical Engineering	M. I. T.
Noon	Reunion, Summer School for Mechanical Engineering, Purdue in 1929	
Afternoon and Evening	Summer Conferences: Civil Engineering and Mechanics (Joint) Machine Design Mechanical Engineering	M. I. T.
Evening	Dinner Meeting: Mechanical Engineering	

Tuesday, June 29

Morning	Summer Conferences: Civil Engineering and Mechanics (Joint) Mechanical Engineering and Machine Design (Joint)	M. I. T.
	Conference: Electrical Engineering and Mathematics (Joint)	M. I. T.
Noon	Meeting, Executive Committee, M. E. Division Civil Engineering Mechanics	M. I. T.

Afternoon	Summer Conferences: Civil Engineering Mechanical Engineering	M. I. T.
	Conferences: Chemical Engineering Electrical Engineering English Machine Design Physics Professional Status and Employment of Engineering Graduates	M. I. T.
Evening	Dinner Meetings: Chemical Engineering Council, M. I. T., Walker Mem., Grill Room	M. I. T.
	Wives of Council	Harv. Faculty Club
	Conferences: Electrical Engineering and Mathematics (Joint) Professional Status and Employment of Engineering Graduates	M. I. T.

Wednesday, June 30

Morning	General Session	Harv.
Noon	Lamme Award Committee Tests and Comprehensive Examinations Two-Year Terminal Program	
Afternoon	Conferences: Chemical Engineering Civil Engineering Cooperative Engineering Education Drawing and Descriptive Geometry Electrical Engineering English Graduate Study Industrial Engineering Machine Design Mathematics Mining and Metallurgy Physics Tests and Comprehensive Examinations	Harv.
	Reception	Harv.

Evening	Dinner Meetings: Civil Engineering Drawing and Descriptive Geometry Electrical Engineering English Mechanics Mining and Metallurgy Physics	As arranged
	Entertainment	

Thursday, July 1

Morning	General Session	Harv.
Noon	Southeastern Section Chemical Engineering	M. I. T.
Afternoon	Joint Conference on Engineering Economy Conferences: Coöperative Engineering Education Drawing and Descriptive Geometry English Guidance of Pre-College Boys Physics Sections and Branches	M. I. T.
Evening	Annual Dinner	M. I. T.

Friday, July 2

Morning	General Session	M. I. T.
Afternoon	Institutional Division Adjournment	M. I. T.

PROGRAM

Wednesday, June 30, 1937

A.M.

7:00 Breakfast Meeting, Harvard Faculty Club, Council of the Society with Chairmen and Secretaries of Conferences.

9:30 Opening Session, New Lecture Hall, Harvard University, H. P. Hammond, President, presiding.

Welcome:

Vannevar Bush, Dean of Engineering and Vice President, Massachusetts Institute of Technology.

Harald M. Westergaard, Dean-elect, Graduate School of Engineering, Harvard University.

Carl S. Ell, Chairman, New England Section.

Response:
H. P. Hammond, President of the Society.

Address:
Karl T. Compton, President, Massachusetts Institute of Technology.

Presidential Address: The Engineering Teacher.
H. P. Hammond, Professor of Civil Engineering, Polytechnic Institute of Brooklyn.

Report of Secretary, F. L. Bishop.

Report of Treasurer, W. O. Wiley.

P.M.

1:30 Conferences. Harvard.

4:00 Reception. Harvard.

6:00 Conference dinners.

8:30 Entertainment: Pops Concert, Boston Symphony Orchestra, Symphony Hall.

Thursday, July 1, 1937

A.M.

7:00 Breakfast Meeting of Council, Harvard Faculty Club.

9:30 Second General Session, New Lecture Hall, Harvard University.

Practical Outcomes of the Study of Education since 1900.
H. W. Holmes, Harvard University.

Administering the Faculty.
W. O. Hotchkiss, Rensselaer Polytechnic Institute.

The Teacher and the Social Significance of the Engineer.
F. W. Feiker, American Engineering Council.
John S. Dodds, Iowa State College.

Discussion.

P.M.

12:30 Visiting M. I. T. Alumni, Luncheon, Walker Memorial, Faculty Dining Room, $0.75.

2:00 Conferences, Massachusetts Institute of Technology.

7:00 Annual Dinner, Massachusetts Institute of Technology, H. P. Hammond, President, presiding.

Election of Officers.

Presentation of Lamme Medal.
Address:
Henry M. Wriston, President, Brown University.

Friday, July 2, 1937

A.M.

7:00 Breakfast Meeting of Council, Harvard Faculty Club.

9:30 Third General Session, Room 5-330, Massachusetts Institute of Technology.
I. C. Crawford, Vice President, presiding.
Development of the Younger Teacher.
Warren K. Lewis, Massachusetts Institute of Technology.
The Engineer as a Servant of Society; A Problem of Education.
T. N. Whitehead, Harvard University.
Role of the Engineer of Tomorrow.
V. M. Faires, A. & M. College of Texas.
Report of Committee on Instructional Standards.
H. S. Rogers, *Chairman*, Polytechnic Institute of Brooklyn.
Looking Ahead in Engineering Education.
F. L. Eidmann, Columbia University.

P.M.

2:00 Fourth General Session, Room 5-330, M. I. T., Institutional Division, Sada A. Harbarger, Vice President, presiding.
Economic and Social Status of the Engineering Teacher.
Paul Cloke, University of Maine.
Report of Committee on Junior Colleges.
W. E. Wickenden, *Chairman*, Case School of Applied Science.
Report of Committee on Orientation of Freshmen.
A. R. Cullimore, *Chairman*, Newark College of Engineering.
Training Engineers in the Art of Human Relations.
F. A. Magoun, Massachusetts Institute of Technology.
Accrediting of Engineering Colleges by E. C. P. D.
I. C. Crawford, University of Idaho.
Report of Committee on Resolutions.
Adjournment.

CONFERENCES

I. Chemical Engineering

F. C. Vilbrandt, Va. Poly. Inst., *Chairman*,
J. C. Elgin, Princeton Univ., *Secretary*.

The chemical-engineering-laboratory facilities of Massachusetts Institute of Technology and the chemical laboratories at Harvard

University will be open for inspection almost anytime during the meeting. At M. I. T., C. S. Robinson will be in Room 2-127 daily between 9–10 A.M. and 1–2 P.M. to serve as local contact man for S. P. E. E. chemical-engineering instructors.

Tuesday, June 29, 1937

P.M.

1:30 M. I. T., Room 4-270.
Greetings, C. S. Robinson, M. I. T.
Response, F. C. Vilbrandt, V. P. I.
Graduate Instruction in Chemical Engineering.
W. H. McAdams, Mass. Inst. Tech.
Discussion:
J. C. Elgin, Princeton Univ.
J. H. Koffolt, Ohio State Univ.
The School of Engineering Practice.
W. G. Whitman, Mass. Inst. Tech.
Discussion: S. H. Stratton, Drexel Inst.

3:15 Visit to Merrimac Chemical Company plant under guidance of Dr. Whitman to see the School of Practice in operation.

6:30 M. I. T., Walker Memorial, Faculty Dining Room, Division Dinner. Informal—Ladies invited. $1.00.

Wednesday, June 30, 1937

P.M.

12:15 Harvard. Divisional Executive Committee meeting.

1:00 Harvard, Mallinckrodt, MB 9, F. C. Vilbrandt, V. P. I., presiding.
Recent Developments in the Teaching of Chemical Engineering Operations.
H. L. Coles, Univ. of Colorado.
Discussion: C. P. Baker, Northeastern Univ.
M. C. Molstad, Yale Univ.
J. R. Lorah, Univ. of Missouri.
Order of Presentation of Chemical Engineering Subjects.
R. C. Kintner, Bucknell Univ.
Discussion: H. L. Masson, New York Univ.
R. A. Fisher, Va. Poly. Inst.
Round Table: Unit Processes:
Unit Processes in Organic Technology.
R. N. Shreve, Purdue Univ.
Thermal Decomposition.
W. Lawrence Faith, Kansas State College.

A Satisfactory Laboratory Method of Teaching Unit Processes.
H. McCormack, Armour Inst. Tech.
Discussion: J. C. Olsen, Poly. Inst. Brooklyn.

P.M. **Thursday, July 1, 1937**

12:15 M. I. T., Walker Memorial, North Hall, Division Luncheon —$0.75.
Business Meeting.
President's Report.
Reports:
Secretary.
Treasurer.
Committee on Chemical Engineering Unit Operations Laboratory. H. McCormack, Chairman.
Committee on Chemical Engineering Unit Processes. R. H. Shreve, Chairman.
Committee on Curricula, sub-committees.
a. Order of Subject Presentation. R. C. Kintner, Chairman.
b. Publication of Divisional Organs.
Nominating Committee.
Election of Officers.

2:00 M. I. T., Room 5-350.
Joint Conference with Engineering Economy.

II. Cooperative Engineering Courses

C. J. Freund, Univ. of Detroit, *Chairman*,
, *Secretary*.

P.M. **Wednesday, June 30, 1937**

2:00 Harvard, Music 4, C. J. Freund, Chairman, presiding.
Significance of Coöperative Employment in the Placement of Graduates.
Claude L. Peake, E. I. du Pont de Nemours & Co.
Discussion: Geo. W. Burns, Univ. of Cincinnati.
J. E. McDaniel, Georgia School of Tech.
Sit-Down Strikes and Coöperative Employment.
Ralph R. Johnson, Univ. of Detroit.

P.M. **Thursday, July 1, 1937**

2:00 M. I. T., Room 2-235, C. J. Freund, Chairman, presiding.
Symposium: Coördinating the Administration of Coöpera-

tive Employment with the Personnel Organizations and Procedures of Coöperating Corporations.
A. R. Cullimore, Newark College of Engineering.
F. A. Kartak, Marquette Univ.
H. P. Dutton, Armour Inst. Tech.
G. R. Cowing, General Motors Inst. Tech.
Discussion.

III. Drawing and Descriptive Geometry

John M. Russ, Univ. of Iowa, *Chairman*,
H. O. Orth, Univ. Wisconsin, *Secretary*.

Wednesday, June 30, 1937

P.M.

2:00 Harvard, Biological Lecture Room, Frank A. Heacock, Princeton Univ., presiding.
Suggested Improvements in Engineering Education.
Wm. G. Smith, Northwestern Univ.
Discussion: Fred W. Slantz, Lafayette College.
Eliot Tozer, Northeastern Univ.
Use of Mirrors in Teaching Orthographic Projection.
H. E. Grant, Univ. of Wisconsin.
The Mechanical Drawing Association of New England.
Albert L. Coyne, Rindge Tech. School, President of Association.

6:00 Harvard Union, Dinner Meeting. $1.00.
The Engineering Drawing Teacher: His Professional Responsibility and Development.
W. E. Wickenden, Case School of Applied Science.
Report of the Judges in the Divisional Competition.
Awarding of shingles.
Business Meeting of Executive Committee.

Thursday, July 1, 1937

P.M.

2:00 M. I. T., Room 4-370.
Motion Pictures with Sound as an Aid to Teaching Engineering Drawing.
Justus Rising, Purdue Univ.
Reports:
Nominating Committee—Election of Officers.
Journal of Engineering Drawing, John M. Russ.
Committee on Graphic Talent Tests, Herman C. Hesse.
Committee on Visualization, Clair V. Mann.

Divisional Seminar Meeting.
Discussion of general topics led by discussion leaders.

IV. Electrical Engineering

A. Naeter, Oklahoma A. & M. College, *Chairman*,
A. A. Nims, Newark College of Engineering, *Secretary*.

Tuesday, June 29, 1937

A.M.

10:00 M. I. T., Room 6-120, Joint meeting with Mathematics.
Basic Mathematics for Electrical Engineering, Thornton C. Fry, Bell Telephone Labs., presiding.

Mathematics Required for the Electrical Engineering Curriculum at M. I. T.
Ernst A. Guillemin, M. I. T.

Mathematics for Electrical Engineering Students in the State University.
Harold W. Bibber, Ohio State Univ.

Mathematical Foundations for Modern Electrical Engineering.
H. W. Bode, Bell Telephone Labs., Inc.

P.M.

2:00 M. I. T., Room 6-120, A. Naeter, Okla. A. & M. College, presiding.

Greeting and Brief Statement Concerning the Electrical Engineering Laboratories at M. I. T., Edward L. Moreland.

The Place of the Reference Librarian in Engineering Teaching, Ruth M. Lane, M. I. T.

Inspection of the Electrical Engineering Laboratory facilities of the Massachusetts Institute of Technology, Carlton E. Tucker, in charge.

7:30 M. I. T., Room 6-120, Joint meeting with Mathematics.
Advanced Mathematics for Electrical Engineering, Thornton C. Fry, Bell Telephone Labs., Inc., presiding.

Operational Calculus.
Alan Hazeltine, Stevens Inst. Tech.

The Missing Link between the Engineer and the Mathematician.
J. L. Synge, Univ. of Toronto.

Value of Tensor Concepts in Electrical Engineering.
A. Boyajian, General Electric Co.

Wednesday, June 30, 1937

P.M.

1:30 Harvard, Cruft 316, Joint meeting with English, A. Naeter, presiding.

Symposium on the objective and minimum content of non-electrical engineering instruction, both technical and non-technical, in the electrical engineering curriculum. To initiate discussions, papers will be presented as follows:

What Price English?
Henry G. Pearson, Mass. Inst. Tech.

Common Technical Elements of the Civil and Electrical Engineering Curricula.
Hale Sutherland, Lehigh Univ.

Teaching of Mechanical Engineering Subjects to Electrical Engineering Students.
R. L. Spencer, Univ. of Delaware.

3:30 Inspection of the Electrical Engineering Laboratory facilities of Harvard University, R. T. Gibbs, in charge.

6:30 M. I. T., Walker Memorial, North Hall, Dinner—$1.00. Informal—Ladies invited.

A. M. MacCutcheon, President, A. I. E. E., hopes to attend this conference.

Thursday, July 1, 1937

P.M.

2:00 M. I. T., Room 5-330, Joint Conference on Engineering Economy.

V. Engineering Economy

Eugene L. Grant, Stanford Univ., *Chairman*,
Geo. W. Barnwell, Stevens Inst. Tech., *Secretary*.

Thursday, July 1, 1937

P.M.

2:00 M. I. T., Room 5-330, E. L. Grant, Stanford Univ., presiding.

Economics of Safety Engineering.
E. A. Holbrook, Univ. of Pittsburgh.

Introducing the Engineering Student to Recent Major Problems of Engineering Economy.
Thos. C. Adams, Univ. of Utah.

Engineering Economy in Relation to Chemical Engineering Instruction.
W. M. Cobleigh, Montana State College.

The Next Step in Engineering Education.
Edmund D. Ayres, Univ. of Wisconsin.
Discussion: F. L. Eidmann, Columbia Univ.
L. R. Guild, Carnegie Inst. Tech.

VI. English

E. C. Elliott, Purdue Univ., *Chairman*,
H. L. Creek, Purdue Univ., *in Charge of Program*,
W. R. Dumble, Ohio State Univ., *Secretary*.

Tuesday, June 29, 1937

P.M.

2:00 M. I. T., Room 2-290, J. L. Vaughan, Univ. of Virginia, presiding.
Round Table Discussion of Plans for the Proposed Investigation of Instruction in English in Engineering Colleges, led by H. L. Creek, Purdue Univ.

Wednesday, June 30, 1937

P.M.

1:30 Harvard, Cruft 316, Joint Conference with Electrical Engineering.
What Price English?
H. G. Pearson, Mass. Inst. Tech.

6:30 M. I. T., Walker Memorial, Grill Room, Dinner Meeting, $1.00. H. L. Creek, Purdue Univ., presiding.
Plan and Development of Courses in the Department of English and History, Massachusetts Institute of Technology.
Howard R. Bartlett, Mass. Inst. Tech.
Teaching Literature to Engineering and Scientific Students.
Robert E. Rogers, Mass. Inst. Tech.
Teaching the History of Science to Undergraduates.
R. S. Woodbury, Mass. Inst. Tech.

Thursday, July 1, 1937

P.M.

2:00 M. I. T., Room 4-231, H. L. Creek, Purdue Univ., presiding.
Experiment in Cooperation Between English and Engineering. The Departments of English and Electrical Engineering, Iowa State College.
W. Paul Jones, Iowa State College.
Workable Methods of Correlation.
W. H. Hildreth, Ohio State Univ.

Michigan Plan of Freshman Work in English.
J. E. Thornton, Univ. of Michigan.
Report and Discussion on *English Notes*.
J. L. Vaughan, Univ. of Virginia.
General R. I. Rees: A Memorial.
C. W. Park, Univ. of Cincinnati.

VII. Graduate Work

Thos. R. Agg, Iowa State College, *Chairman*.

Wednesday, June 30, 1937

P.M.

2:00 Harvard, Music 2, Thos. R. Agg, Iowa State College, presiding.
Formal Discussions:
What is Graduate Study in Engineering?
Are There Valid Reasons for Conducting Engineering Graduate Study in Accordance with the Traditional Practices in the Philosophical Fields?
F. Ellis Johnson, Univ. of Missouri.
What Are the Criteria by Which to Measure the Suitability of Prospective Teachers of Graduate Subjects?
Jos. W. Barker, Columbia Univ.
Informal Discussions:
How Many Institutions Encourage High-ranking Students to Continue their Studies beyond the Baccalaureate Degree?
C. A. Pierce, Worcester Poly. Inst.
Specifications for the Graduate Thesis.
H. L. Hazen, Mass. Inst. Tech.
Graduate Work through the Medium of Coöperative Courses.
E. B. Roberts, Westinghouse E. & M. Co.
Do the Oral Examinations of Candidates for Advanced Degrees Really Serve a Useful Purpose?
Hardy Cross, Univ. of Illinois.

VIII. Guidance of Pre-College Boys

W. B. Plank, Lafayette College, *Chairman*.

Thursday, July 1, 1937

P.M.

3:00 M. I. T., Room 2-290.
Round Table Discussion.

IX. Industrial Engineering

Paul T. Norton, Va. Poly. Inst., *Chairman*,
A. S. Knowles, Northeastern Univ., *Secretary*.

Wednesday, June 30, 1937

P.M.

2:00 Harvard, Students' Astronomical Laboratory, Paul T. Norton, presiding.

The Technical School Prepares for Industrial Marketing.
John R. Bangs, Jr., Cornell Univ.

Teaching Motion Economy.
Myron A. Lee, Cornell Univ.

Technical and Business Options in Engineering Curricula.
C. L. Eddy, Case School of Applied Science.

Trends in the Teaching of Management at M. I. T.
Erwin H. Schell, Mass. Inst. Tech.

Discussion.

X. Lamme Award Committee

E. B. Roberts, Westinghouse E. & M. Co., *Chairman*.

Wednesday, June 30, 1937

P.M.

12:15 Luncheon Meeting of Committee.

XI. Machine Design

A. W. Luce, Lehigh Univ., *Chairman*,
Edgar MacNaughton, Tufts College, *Secretary*.

Monday, June 28, 1937

P.M.

7:30 M. I. T., Room 3-470, A. W. Luce, presiding.

Round Table Discussion.

Subject: Advances and Trends in the Teaching of Machine Design and Related Subjects. (5-minute subject introductions.)

How Should the New Gear Design Be Taught?
Earle Buckingham, Mass. Inst. Tech.

Contribution of Photo-Elasticity to Machine Design.
John A. Prior, Univ. of Pennsylvania.

Is There a Rational Approach to the Treatment of Factors of Safety?
J. Harland Billings, Drexel Inst.

Tuesday, June 29, 1937

A.M.

9:30 M. I. T., Room 3-370, F. W. Marquis, Ohio State Univ., presiding.
Joint Conference with Mechanical Engineering.

Wednesday, June 30, 1937

P.M.

2:00 Harvard, Music 1.
Use of Visual Aids in Teaching Machine Design.
Ward E. Bullock, Univ. of Cincinnati.
Discussion: Herman C. Hesse, Univ. of Virginia.
Gear Design.
Earle Buckingham, Mass. Inst. Tech.
Discussion.

Thursday, July 1, 1937

P.M.

2:00 M. I. T., Room 5-330. Joint Conference with Engineering Economy.

XII. Mathematics

T. C. Fry, Bell Tel. Labs. Inc., *Chairman*,
J. H. Weaver, Ohio State Univ., *Secretary*.

Tuesday, June 29, 1937

A.M.

10:00 M. I. T., Room 6-120, Joint with Electrical Engineering.
Basic Mathematics for Electrical Engineering.
(See page 635 for details.)

P.M.

7:30 M. I. T., Room 6-120, Joint with Electrical Engineering.
Advanced Mathematics for Electrical Engineering.
(See page 635 for details.)

Wednesday, June 30, 1937

P.M.

2:00 Harvard, Mallinckrodt MB 8, Thornton C. Fry, Bell Telephone Labs., presiding.
Application of the Differential Analyser to the Solution of Ordinary Differential Equations.
Samuel H. Caldwell, Mass. Inst. Tech.
Applicability of the LaPlace Transformation.
John L. Barnes, Tufts College.

6:00 Harvard Faculty Club, Dinner. $1.25.

XIII. Mechanics

H. J. Gilkey, Iowa State College, *Chairman*,
Glen Murphy, Iowa State College, *Secretary*.

Monday, June 28, 1937

P.M.

2:00 M. I. T., Room 5-330, Joint Session with Civil Engineering Division.

3:00 M. I. T., Room 1-275, Z. R. Bliss, Brown University, presiding.

Aids in Teaching Mechanics.
E. W. Rettger, Cornell Univ.

Realism in Teaching Mechanics.
W. J. Cox, Yale Univ.

What Departments Teach Mechanics?
H. J. Gilkey, Iowa State College.
F. E. Lightburn.

A New Method of $P + Q$ Determination in Photo-Elasticity.
G. H. Shortley and Royal Weller, Ohio State Univ.

Appointment of a Nominating Committee.

Tuesday, June 29, 1937

A.M.

9:00 M. I. T., Room 5-330, Joint Session with Civil Engineering Division.

10:30 M. I. T., Room 1-275, W. R. Cornell, Cornell Univ., presiding.

Materials Laboratory, Objectives and Methods.
John S. Peck, College, City of N. Y.

Graduate Work in Mechanics.
J. P. Den Hartog, Harvard Univ.

Fluid Mechanics.
Samuel R. Beitler, Ohio State Univ.

Discussion: M. J. Thompson, Univ. of Michigan.

P.M.

12:15 M. I. T., Walker Memorial, Faculty Dining Room, Division Luncheon. $0.75.

Afternoon to be free for members to visit laboratories or make other contacts.

Wednesday, June 30, 1937

P.M.

6:00 M. I. T., Walker Memorial, Faculty Dining Room, Annual Dinner and Election. $1.00.

Arguments About This and That.
H. M. Westergaard, Harvard Univ.

XIV. Mining and Metallurgy

W. B. Plank, Lafayette College, *Chairman*,
Secretary.

Wednesday, June 30, 1937

P.M.

2:00 Harvard, Rotch 1. W. B. Plank, presiding.
Aims and Objectives of Metallurgical Engineering Education.
G. E. Doan, Lehigh Univ.
Educational Problems in Mineral Technology.
H. P. Hammond, President, S. P. E. E.
Discussion: Bradley Stoughton, Lehigh Univ.
A. F. Greaves-Walker, No. Car. State College.
E. A. Holbrook, Univ. Pittsburgh.
F. B. Plummer, Univ. of Texas.
T. T. Read, Columbia Univ.

6:30 Harvard Faculty Club, Dinner Meeting, $1.25. E. A. Holbrook, Univ. Pittsburgh, presiding.
Discussion of Proposed Plan for Formation of a Division of Mineral Technology.

XV. Physics

D. S. Elliott, Tulane Univ., *Chairman*,
P. B. Fraim, Poly. Inst. of Brooklyn, *Secretary*.

Tuesday, June 29, 1937

P.M.

2:00 Visit to M. I. T. Laboratories, starting with Physics Laboratory.

Wednesday, June 30, 1937

P.M.

1:30 Harvard, Pierce 202, D. S. Elliott, presiding.
Physics in European Technical Schools.
G. E. Grantham, Cornell Univ.
Laboratory Method as a Teaching Medium.
F. W. Gager, Boston College.
Pre-Engineering Physics.
W. L. Severinghaus, Columbia Univ.
Instruction in Shop Work for Physics Students.
Wm. T. Bovie, Colby College.
Demonstration Lecture in Physics.
N. H. Black, Harvard Univ.

6:30 Physics Dinner, followed by visit to the Harvard Observatory.

Thursday, July 1, 1937

P.M.

1:30 M. I. T., Room 10-267, D. S. Elliott, presiding.
Applied Physics.
Geo. R. Harrison, Mass. Inst. Tech.
Place of Graduate Work in the Preparation of Industrial Physicists.
Wheeler P. Davey, Penna. State College.
The Making of Industrial Physicists.
John Mills, Bell Telephone Labs.
Accrediting of Engineering Physics Curricula as Engineering.
E. C. Bidwell, Lehigh Univ.

XVI. Professional Status and Employment of Engineering Graduates

John R. Bangs, Jr., Cornell Univ., *Chairman*,
F. A. Magoun, Mass. Inst. Tech., *Secretary*.

Tuesday, June 29, 1937

P.M.

2:00 M. I. T., Room 4-370, O. W. Eshbach, American Tel. & Tel. Co., presiding.
Summary of Previous Meetings.
J. E. Walters, Purdue Univ.
College Interviewing Under Changing Economic Conditions:
From the Viewpoint of the Colleges.
John R. Bangs, Jr., Cornell Univ.
J. R. Moynihan, Cornell Univ.
From the Viewpoint of Industry.
M. M. Boring, General Electric Co.
Discussion: F. G. Atkinson, Procter & Gamble Co.
P. W. Boynton, Socony-Vacuum Co.
J. H. Dillon, Ingersoll-Rand Co.
K. A. Meade, General Motors Corp.
T. W. Prior, Goodyear Tire & Rubber Co.

7:30 M. I. T., Room 4-370, M. M. Boring, General Electric Co., presiding.
College Interviewing Under Changing Economic Conditions.
Summary of Afternoon Session with Recommendations.
Educating Engineers to Meet Their Social Responsibilities.
E. S. Burdell, Mass. Inst. Tech.

Discussion: O. W. Eshbach, American Tel. & Tel. Co.
F. A. Magoun, Mass. Inst. Tech.
H. L. Davis, New York Telephone Co.

XVII. Sections and Branches

Geo. W. Case, Univ. of New Hampshire, *Chairman*,
Secretary.

Thursday, July 1, 1937

P.M.
2:00 M. I. T., Room 2-143, Geo. W. Case, presiding.

XVIII. Southeastern Section

W. S. Rodman, Univ. of Virginia, *Chairman*.

Thursday, July 1, 1937

P.M.
12:15 Luncheon Meeting.

XIX. Tests and Comprehensive Examinations

C. V. Mann, Mo. School of Mines, *Chairman*,
Secretary.

Wednesday, June 30, 1937

P.M.
12:15 Harvard Faculty Club, Luncheon Meeting of Committee. $1.00.
2:00 Harvard, Mallinckrodt MB 23, C. V. Mann, presiding.

XX. Two-Year Terminal Program

B. R. Van Leer, Univ. of Florida, *Chairman*.

Wednesday, June 30, 1937

P.M.
12:15 Harvard Faculty Club, Luncheon Meeting of Committee. $1.00.

Summer Conferences

Civil Engineering

L. E. Grinter, A. & M. College of Texas, *Chairman*,
K. C. Reynolds, Mass. Inst. Tech., *Secretary*.

Monday, June 28, 1937

P.M.

2:00 M. I. T., Room 5-330, Joint Meeting with Mechanics, L. E. Grinter, presiding.

Educational Inflation.
Hardy Cross, Univ. of Illinois.

History of Some Concepts of Mechanics.
Jasper O. Draffin, Univ. of Illinois.

3:00 Group Discussions.

M. I. T., Room 1-271.

a. Hydraulics and Sanitary. Theodore Mavis, Univ. of Iowa, presiding.

Teaching of Hydrology.
E. W. Lane, Univ. of Iowa.

Introduction of Fluid Mechanics into the Course in Hydraulics.

M. I. T., Room 5-330.

b. Structural. Hale Sutherland, Lehigh Univ., presiding.

Place of Indeterminate Structures in the Civil Engineering Curriculum.
Fred L. Plummer, Case School of Applied Science.

Teaching Indeterminate Structures to Undergraduates.
H. E. Wessman, New York Univ.

Discussion: E. H. Gaylord, Ohio Univ.
Hardy Cross, Univ. of Illinois.

7:30 Group Discussions.

M. I. T., Room 1-143.

a. Transportation Studies. J. B. Babcock, Mass. Inst. Tech., presiding.

Besler Steam Two-Car Train.
G. D. Besler.

Modern Trends in Transportation Courses.
W. J. Cox, Yale Univ.

Content of a Course in Railroads.
H. C. Bird, Duke Univ.

Modern Course in Highways.
H. T. Hickerson, Univ. No. Car.

M. I. T., Room 1-190.

b. Construction Engineering Education. L. E. Conrad, Kansas State College, presiding.

Course in Construction Engineering.
F. W. Stubbs, Rhode Island State College.

Teaching Construction—the Part of Industry, the College, and the Student.
W. C. Voss, Mass. Inst. Tech.

Construction Accounting in Relation to Engineering Education.
E. L. Grant, Stanford Univ.

M. I. T., Room 1-147.

c. Sanitary Engineering. R. G. Tyler, Univ. of Washington, presiding.

Some Notes on Teaching and Practice of Sanitary Engineering.
W. E. Stanley, Cornell Univ.

Standardizing Sanitary Engineering Curricula.
W. E. Howland, Purdue Univ.

Should a Sanitary Engineering Instructor Be Interested in Stream Pollution Elimination?
Thorndike Saville, New York Univ.

Tuesday, June 29, 1937

A.M.

9:00 M. I. T., Room 5-330.

Joint Meeting with Mechanics. H. J. Gilkey, Iowa State College, presiding.

Should the Course Content of the Mechanics of Materials Be Varied to Meet the Special Needs of Such Subsequent Courses as

Machine Design.
V. M. Faires, A. & M. College of Texas.
Discussion: S. W. Dudley, Yale Univ.
O. A. Leutwiler, Univ. of Illinois.
J. A. Orr, A. & M. College of Texas.

Structural Engineering.
Frank Kerekes. Iowa State College.
Discussion: E. O. Sweetser, Washington Univ.
C. L. Eckel, Univ. of Colorado.
M. O. Withey, Univ. of Wisconsin.

10:30 Group Discussions.

M. I. T., Room 1-271.

a. Sanitary and Hydraulics. H. E. Babbitt, Univ. of Illinois, presiding.

Some Observations on the Teaching of Sanitary Engineering.
Gordon Fair, Harvard Univ.

Project Method in the Teaching of Sanitary Engineering.
Harold A. Vagtborg, Armour Inst. Tech.

M. I. T., Room 3-470.

b. Soil Mechanics. E. E. Bauer, Univ. of Illinois, presiding.

A New Approach to the Teaching of Foundation Engineering.
P. C. Rutledge, Harvard Univ.

Teaching Soil Mechanics.
Fred L. Plummer, Case School of Applied Science.

Activities of the Soil Mechanics Committee of the Engineering Societies and their Relation to Instruction in Soil Mechanics.
Wm. P. Kimball, Dartmouth College.

Stress Distribution in Soils.
D. P. Krynine, Yale Univ.

Discussion: A. Casagrande, Harvard Univ.
D. W. Taylor, Mass. Inst. Tech.

M. I. T., Room 1-236.

c. Surveying and Geodesy. H. M. Dibert, W. & L. E. Gurley Co., presiding.

Resume of W. H. Rayner's Report on Recent Trends in Surveying Instruction.
O. S. Zelner, Univ. of Minnesota.

Professional Practice of Land Surveying as Related to Teaching.
Paul P. Rice, Lafayette College.

Discussion: Earl Church, Syracuse Univ.
H. J. Shea.
S. S. Steinberg, Univ. of Maryland.
P. H. Underwood, Cornell Univ.

Announcements and Committee Reports.
Paul P. Rice.

P.M.

12:15 M. I. T., Walker Memorial, North Hall.
Division Luncheon. $0.75.

2:00 M. I. T., Room 3-270, Hale Sutherland, Lehigh Univ., presiding.

Graduate Study in Civil Engineering.

Structural Engineering, Theory and Tests.
Clyde T. Morris, Ohio State Univ.

Hydraulic Engineering.
F. T. Mavis, Univ. of Iowa.

Highway Engineering, Use of Field Tests.
T. R. Agg, Iowa State College.

Objectives of Graduate Work in Civil Engineering.
S. C. Hollister, Cornell Univ.

Discussion: Lorenz Straub, Univ. of Minnesota.
C. W. Dunham, Port of N. Y. Authority.

Wednesday, June 30, 1937

P.M.

2:00 Harvard, Pierce 110, H. S. Rogers, Poly. Inst. of Brooklyn, presiding.

Scope and Organization of the Civil Engineering Curriculum.
General Discussion of the Curriculum.
H. T. Heald, Armour Inst. Tech.

Sequence of Courses in Structures.
Frank Kerekes, Iowa State College.

Sequence of Courses in Hydraulics and Sanitation.
R. G. Tyler, Univ. of Washington.

Collateral Work in the Humanities.
J. K. Finch, Columbia Univ.

6:00 Hotel Continental, near Harvard Square, Cambridge.
Annual Dinner of Division. $1.25.

Welcome.

Election of Officers.

Remarks by the Chairman.

Address:
C. C. Williams, President, Lehigh Univ.

Thursday, July 1, 1937

P.M.

2:00 M. I. T., Room 5-330.
Joint Session on Engineering Economy.

Mechanical Engineering

Frank L. Eidmann, Columbia Univ., *Chairman*,
F. D. Carvin, Newark College of Engineering, *Secretary*.

Monday, June 28, 1937

A.M.

10:00 M. I. T., Room 3-370, Frank L. Eidmann, presiding.
R. L. Sweigert, Ga. School of Tech., *Recorder*.

How Is Present-Day Training of Mechanical Engineers to Recognize the Transition from the Practical Engineer of 25 Years Ago to the Applied Scientist of Today?
J. C. Hunsaker, Mass. Inst. Tech.

Discussion: S. W. Dudley, Yale Univ.
H. A. Everett, Penna. State College.
M. D. Hersey, Kingsbury Machine Works.
D. B. Prentice, Rose Poly. Inst.
M. J. Thompson, Univ. of Michigan.

P.M.

12:15 Luncheon, M. I. T., Walker Memorial, North Hall. Reunion of those who attended Summer School for Mechanical Engineering at Purdue University in 1929. $0.75.
B. M. Brigman, Univ. of Louisville, presiding.

2:00 M. I. T., Room 3-370. Business Meeting.
F. L. Eidmann, Chairman of Division.
F. D. Carvin, Secretary of Division.

2:30 M. I. T., Room 3-370, B. G. Elliott, Univ. of Wisconsin, presiding.
C. H. Casberg, Univ. of Illinois, *Recorder*.

What Are the Aims and Objectives of Mechanical Engineering Education?
Geo. A. Orrok, Consulting Engineer.

Discussion: A. G. Christie, Johns Hopkins Univ.
V. M. Faires, A. & M. College of Texas.
F. V. Larkin, Lehigh Univ.
R. L. Sackett, Penna. State College.
A. Sloane, Mass. Inst. Tech.

6:30 M. I. T., Walker Memorial, North Hall, Informal Dinner. $1.25.
C. E. Davies, Secretary, A. S. M. E., *Toastmaster*.
G. K. Palsgrove, Rensselaer Poly. Inst., *Recorder*.

Remarks:
H. P. Hammond, President, S. P. E. E.
F. L. Bishop, Secretary, S. P. E. E.
Nell McKenry, Assistant Secretary, S. P. E. E.
C. H. Berry, Harvard Univ.

Address: Who Is a Good Teacher?
Karl T. Compton, President, Mass. Inst. Tech.

7:30 Round Table Discussion Groups.
M. I. T., Room 1-132, C. H. Berry, Harvard Univ., presiding.

Advances and Trends in the Teaching of Heat Engineering.

M. I. T., Room 1-134, J. W. Haney, Univ. of Nebraska, presiding.

Advances and Trends in the Teaching of Mechanical Laboratory.

M. I. T., Room 1-146, A. W. Luce, Lehigh Univ., presiding.

What Should the Undergraduate Machine Design Course of the Future Contain?

Discussion: J. H. Billings, Drexel Inst.

M. I. T., Room 1-150, R. M. Barnes, Univ. of Iowa, presiding.

Advances and Trends in the Teaching of Heat Treating and Metallurgy.

M. I. T., Room 1-271, B. R. Van Leer, Univ. of Florida, presiding.

Advances and Trends in the Teaching of Hydraulics and Fluid Mechanics.

M. I. T., Room 1-275, G. N. Moffat, Ohio State Univ., presiding.

How Should the Selection of Materials for Engineering Projects Be Taught?

Tuesday, June 29, 1937

A.M.

9:30 M. I. T., Room 3-370, Joint Conference with Machine Design.

F. W. Marquis, Ohio State Univ., presiding.

E. MacNaughton, Tufts College, *Recorder*.

Summaries of Round Table Discussions by Group Chairmen.

Open Discussion:

Factors Contributing to Effective Teaching of Mechanical Engineering.

A. A. Potter, Purdue Univ.

P.M.

12:15 M. I. T., Walker Memorial, Silver Room, Luncheon Meeting of Executive Committee. $0.75.

2:00 M. I. T., Room 3-370, R. M. Barnes, Univ. of Iowa, presiding.

L. G. Miller, Mich. State College, *Recorder*.

What Subjects of Instruction Should Be Included in all Courses in Mechanical Engineering?

F. D. Carvin, Newark College of Engineering.

Discussion: J. H. Billings, Drexel Inst.
H. O. Croft, Univ. of Iowa.
C. G. Thatcher, Swarthmore College.
J. W. Zeller, Northeastern Univ.

Some Comments from Industry Regarding Present Training of Mechanical Engineering Students.
F. L. Eidmann, Columbia Univ.

Economics

E. L. Grant, Stanford Univ., *Chairman.*

This conference is held at the Stevens Institute of Technology Engineering Camp at Johnsonburg, N. J., June 18 to June 26 inclusive. Arrangements may be made for a camp car to meet trains at Johnsonburg or at Blairstown. There are excellent roads to camp from Philadelphia and New York (about 60 miles). Enrollment should be made by letter to President Harvey N. Davis, Stevens Institute of Technology, Hoboken, N. J. One fee, $40.00, payable on arrival at camp, covers the enrollment fee, tuition, and all camp expenses, including camp and conference activities, bed and board, linen, blankets, towels, etc.

LOCAL COMMITTEES

General: Vannevar Bush, *Chairman,* H. R. Mimno, Carl S. Ell, H. P. Burden, C. E. Tucker, *Executive Secretary,* A. E. Norton, A. L. Townsend, K. C. Reynolds, C. Frank Allen, D. C. Jackson, G. C. Anthony.

Registration: Jesse J. Eames, *Chairman,* R. H. Frazier, J. C. MacKinnon, J. W. Howard.

Publicity: W. H. Timbie, *Chairman,* C. L. Dawes, C. E. Locke, J. J. Rowlands, A. Wilde.

Transportation and Parking: J. B. Babcock, *Chairman,* R. P. Siskind, Wm. H. Jones.

Inspection Trips: Edgar MacNaughton, *Chairman,* T. H. Taft, J. B. Wilbur, Harold C. Weber, R. T. Gibbs, E. W. Kimbark, F. P. Fischer.

Information and Signs: F. A. Magoun, *Chairman,* L. M. Dawes, J. E. Mulligan, George F. Ninde.

Entertainment: C. L. Dawes, *Chairman,* Carl S. Ell, B. A. Thresher, W. C. Voss, C. E. Lansil, W. H. McAdams, L. S. Marks.

Conferences and Exhibits: Henry B. Phillips, *Chairman,* G. M. Fair, E. F. Watts, Alvin Sloane, C. Neitzert.

	Friday June 18	Saturday June 19	Sunday June 20	Monday June 21	Tuesday June 22	Wednesday June 23	Thursday June 24	Friday June 25	Saturday June 26
		COURSE CONTENT AND TEACHING METHODS							
1st Morning Hour 8:45 A.M.	Registration and Cabin Assignments: Issue of Camp Equipment	Economic Theory Karl Scholz Wharton School, University of Pennsylvania	Engineering Economics Scott B. Lilly Swarthmore College, with discussion led by Frank L. Eidmann Columbia University	Accounting Eugene L. Grant Stanford University with discussion led by C. L. Van Sickle University of Pittsburgh	Interrelations of Economic Theory, Engineering Economics, Accounting Eugene L. Grant	Industrial Management Paul T. Norton, Jr. Virginia Polytechnic Institute with discussion led by C. L. Eddy Case School of Applied Science	Interrelations of Engineering Economics, Accounting, Industrial Management Paul T. Norton, Jr.	Bread and Butter Economics K. W. Jappe Engineer and Economist, formerly President, Brookmire Economic Service	Opportunities in the Borderline Field Edmund D. Ayres University of Wisconsin, with discussion led by Allan R. Cullimore President, Newark College of Enigineering
		INDUSTRIAL ECONOMICS Conducted by Dexter S. Kimball, formerly Dean of Engineering, Cornell University, and W. D. Ennis							
2d Morning Hour 10:30 A.M.		Dexter S. Kimball: Great Inventions and other Economic Influences	Dexter S. Kimball: Basic Economic Effects of New Tools and Processes	Dexter S. Kimball: Economic Factors Determining Scale of Plant	Dexter S. Kimball: Industrial Democracy	W. D. Ennis: The Nation's Growth	W. D. Ennis: Economic Activities	W. D. Ennis: Manufacturing	W. D. Ennis: The National Income and its Distribution
		AFTERNOONS FREE FOR RECREATION: SWIMMING AND SPORTS AT CAMP; Ggolf and tennis near by							
Evening Lecture	What Engineers Should Know about Labor Problems	The National Income, Wages and Prices	Fundamental Changes in our Economy	Training and Wages of Industry	Financing Social Security	The Effect of Government Policies on Engineering Industries	The Constitution and the Courts	Industrial Relations	
8:15 P.M.	John M. Carmody Administrator, Rural Electrification Administration, formerly Member National Labor Relations Board	Seymour L. Andrew Chief Statistician, American Telephone and Telegraph Company	Ralph E. Flanders President, Jones & Lamson Machine Company	F. V. Larkin Director, Department of Mechanical Engineering, Lehigh University	J. Frederick Dewhurst Economist, Twentieth Century Fund	W. H. Rastall formerly Chief of Industrial Machinery Division, U. S. Department of Commerce	Noel T. Dowling Nash Professor of Law, Columbia University Law School	A. R. Mathieson Assistant to the Vice President, United States Steel Corporation	

In addition to the courses indicated above, the following will be available:
1st morning hour: 8 lectures by Geo. W. Barnwell, Stevens Institute of Technology.
2nd morning hour: Industrial Psychology, 8 lectures, by R. S. Uhrbrock, Procter & Gamble Co.

Housing and Regular Meals: K. C. Reynolds, *Chairman*, G. B. Hoadley, R. D. Douglass, D. L. Rhind, James Biggar.

Reception: J. P. den Hartog, *Chairman*, H. G. Pearson, G. W. Swett, T. R. Camp, C. H. Berry, A. W. Horton.

Banquets and Group Dinners: E. Mirabelli, *Chairman*, R. H. Smith, E. L. Bowles, W. E. Farnham.

Ladies: Mrs. V. Bush, *Chairman*, Mrs. H. R. Mimno, Mrs. H. P. Burden, Mrs. Carl S. Ell, Mrs. G. M. Fair, Mrs. A. A. Blanchard, Mrs. C. E. Tucker, Mrs. K. C. Reynolds, Mrs. F. B. Hunt.

Hostess: Mrs. C. H. Berry, *Chairman*, Mrs. Walter Farnham, Mrs. C. B. Breed, Mrs. W. H. Timbie, Mrs. J. H. Keenan.

Care of Children: Mrs. C. E. Tucker, *Chairman*, Mrs. T. S. Gray, Mrs. Albert Haertlein, Mrs. J. E. Mulligan, Mrs. J. E. Shepherd, Mrs. J. C. Slater, Mrs. A. Sloane, Mrs. C. E. Lansil.

Lexington and Concord Trip: Mrs. K. C. Reynolds, *Chairman*, Mrs. Carle R. Hayward, Mrs. Louis B. Slichter.

North Shore Trip: Mrs. H. R. Mimno, *Chairman*, Mrs. G. M. Fair, Mrs. F. B. Hunt, Mrs. R. P. Siskind, Mrs. A. A. Blanchard, Mrs. J. J. Eames, Mrs. G. W. Swett, Mrs. T. H. Taft.

Bridge Committee: Mrs. H. B. Dwight, *Chairman*, Mrs. C. L. Dawes, Mrs. W. H. Timbie.

Museum Trips: Mrs. L. M. Dawes, *Chairman*, Mrs. W. H. McAdams, Mrs. J. P. den Hartog, Mrs. R. D. Douglass, Mrs. A. E. Norton.

HEADQUARTERS AND REGISTRATION

Headquarters and registration for both entertaining host institutions will be centralized in the lobby (under the dome) of the main educational group at M. I. T. on Memorial Drive (north side of Charles River), corner of Massachusetts Avenue, Cambridge (Routes U. S. 1; Mass. 2, 2A, 28, 38). The two institutions are about 1½ miles apart with direct surface car and subway train transportation. There is a large free parking area in the rear of the Institute buildings and suitable parking space at Harvard.

From South Station (Boston and Albany R. R. and New York, New Haven and Hartford R. R.), take Cambridge Subway train westbound to Central Square (fifth stop). Obtain transfer before leaving station and take surface car marked "Mass. Station." Leave car at M. I. T. (before crossing Charles River). Those staying at Boston hotels listed below should leave train at Huntington Avenue or Back Bay Station.

From North Station (Boston and Maine R. R.), opposite Track 16 take stairs up to elevated street car platform. Take any in-bound

1st morning hour: 8 lectures by Geo. W. Barnwell, Stevens Institute of Technology.
2nd morning hour: Industrial Psychology, 8 lectures, by R. S. Uhrbrock, Procter & Gamble Co.

car to Massachusetts Station (seventh stop). Transfer upstairs to car marked "Harvard" and leave it at M. I. T. (just across Charles River).

Members of the Registration Committee will be on duty in the main lobby at M. I. T. as follows:

Saturday, June 26, to Thursday, July 1, 9:00 A.M. to 9:00 P.M.
Friday, July 2, 9:00 A.M. to 4:00 P.M.

Massachusetts operates on Daylight Saving Time which means that the clock is advanced one hour with respect to Eastern Standard Time. *All events for this convention will be scheduled on Daylight Saving Time.*

HOUSING

Excellent sleeping accommodations will be available at dormitories of the two host institutions. There are two hotels in Cambridge and many across the river in Boston. There is a satisfactory tourist camp in Malden, located about five miles from Cambridge. Information on this camp may be obtained from Prof. J. J. Eames, M. I. T.

Dormitories at Harvard University.—These dormitories, accommodating about 750, will be open to members, guests and their families, including children. They are located within the Yard of the University. Many have suites accommodating 2, 3, or 4. The price of these rooms will be $1.00 per person per day, payable in advance at the Registration Desk at M. I. T. All rooms are completely furnished, including bed linen and towel service.

Dormitories at M. I. T.—These dormitories, accommodating about 200, will be open to *men only*. They are located adjacent to the main building of the Institute. The price of these rooms will be $1.00 per person per day, payable in advance at the Registration Desk. All rooms are completely furnished, including bed linen and towel service.

For all dormitory reservations, write to Professor J. J. Eames, M. I. T.

HOTELS

The Commander Hotel, Harvard Sq., Camb., Single Room $2.50, Double Room $4.00.

Hotel Continental, Harvard Sq., Camb., Single Room $2.50–3.00, Double Room $5.00.

Hotel Kenmore, Boston, Single Room $3.50, Double Room $5.00.

The Myles Standish, Boston, Single Room $3.00–3.50, Double Room $4.00–4.50.

Hotel Statler, Boston, Single Room $3.50–8.00, Double Room $5.00–12.00.

University Club, Boston, Single Room $2.50 up, Double Room $4.00 up.

All of the above rooms are with bath. There are many other excellent hotels available in Boston. Guest cards for the University Club will be issued to those applying at the Registration Desk.

Reservations for hotel rooms should be made directly with the hotel.

Note: **It will greatly facilitate all plans of the local committees if everyone expecting to attend will send in the reservation card, appropriately checked, to Professor J. J. Eames, M. I. T., promptly.**

Reservations for group luncheons and dinners must be made 24 hours in advance. A green reservation card is being mailed to all who send advance registration to Prof. Eames.

Reservations for trips must likewise be made in advance on the salmon reservation card.

MEALS

Cafeteria service for all meals will be available June 28 through July 2 at M. I. T. in the main hall of Walker Memorial Building. (Meals average 30 to 65 cents.) Provisions are being made for conference dinners and luncheons in smaller dining rooms at Walker Memorial and elsewhere.

For those living in the Harvard dormitories, dining service will be available at the Harvard Union.

COMMUNICATIONS

Mail and telegrams should be addressed:

S. P. E. E. Headquarters
Mass. Institute of Technology
Cambridge, Mass.

Telephone: KIRkland 6900.

ENTERTAINMENT

The local committee on entertainment in cooperation with the ladies' committee is planning many special functions for the entertainment of our guests. These are scheduled to be a showing of high-speed motion pictures and colored motion pictures of New England followed by an informal dance on Monday evening; talking motion pictures of the Harvard Tercentenary followed by an informal dance on Tuesday evening; a Pops Concert by the Boston Symphony Orchestra on Wednesday evening complimentary to the visiting members and their immediate families.

Information will be available at the registration desk telling about the necessary arrangements for sight-seeing trips of historic

and modern Boston, and boat trips or combination boat and rail trips to Nantasket, Provincetown, Plymouth, or Nantucket.

Arrangements are also being made for those who desire to play tennis at Harvard or M. I. T., for sight-seeing trips on the Charles River, and for those who care to play golf to have guest privileges at some of the country clubs in the vicinity.

The ladies' committee is at work formulating plans for entertaining the visiting ladies and children.

LADIES' PROGRAM

Monday Evening, 8:00 P.M.*—Edgerton High-Speed Motion Pictures and Colored Motion Pictures of New England followed by an Informal Dance, Walker Memorial.

Tuesday Afternoon—Bridge Party at President Compton's home or Visit to the Gardner Museum. (Transportation provided for museum trip. Admission to museum, $0.25.)

Tuesday Afternoon, 5:00 P.M.—Tea at President Compton's home. (Busses from museum trip will return in time for the tea.)

Tuesday Evening, 8:00 P.M.—Complimentary dinner to the Council and to ladies of Council members.

Tuesday Evening, 8:00 P.M.*—Talking Motion Pictures of Harvard Tercentenary followed by Informal Dance, Walker Memorial.

Wednesday—Trip to the University and Fogg Museums of Harvard University.

Wednesday Afternoon*—President's Reception at Eliot House, Harvard.

Wednesday Evening*—Pops Concert, Boston Symphony Orchestra, Symphony Hall.

Thursday—All day trip to Lexington and Concord with luncheon at The Wayside Inn or trip on the North Shore for those who prefer ocean scenery with a shore dinner enroute. Price $1.50. (Children under 12 years $1.00.)

Thursday Evening*—Annual Dinner, Walker Memorial. Price $1.50 per plate.

Friday—It is assumed that probably many will want to take a shopping trip to the stores of Boston or to arrange individually for one of the numerous sight-seeing trips about the city which are available or to arrange for a sail to Provincetown, Plymouth, or to Nantucket.

*Open to all attending the convention.

CHILDREN'S PROGRAM

Tuesday Afternoon—Boat ride on Charles River, $0.50.

Wednesday Morning—Trip to Mapparium-spherical room at Christian Science Publishing Company.

Wednesday—Trip to the University Museum of Harvard University—Glass flowers and model forest.

Thursday—It is suggested that children take one of the trips listed for ladies.

Friday Morning—Trip to Children's Museum and Franklin Park.

TRIPS

Motor trips to points of historical interest, such as Lexington, Concord, Salem, Marblehead, Plymouth, Gloucester, and The Wayside Inn at Sudbury, offer delightful diversion for the visitor. Those desiring to remain over the week end have many interesting trips to choose from, such as: the White Mountains, quaint Cape Cod, Arnold Arboretum, the many historical buildings in Boston and vicinity, engineering features of Cape Cod canal, and M. I. T. experiment station at South Dartmouth.

LABORATORY VISITS

The famous exhibit of glass flowers, and the model forest in the University Museum at Harvard University should be seen by all members. Visits to the engineering laboratories may be taken at any time. However, it has been arranged to have members of the various departments in the laboratories as follows:

Harvard University—*Wednesday afternoon and Thursday morning.*
Massachusetts Institute of Technology—*Tuesday and Thursday afternoons.*

The Engineering laboratories at Tufts College and Northeastern University may be visited by members who desire to see these schools; also the laboratories of Worcester Polytechnic Institute at Worcester and at Chaffins.

INDUSTRIAL PLANT VISITS

Arrangements have been made for members to visit the following industrial plants in the Boston area. These visits may be made at the time specified by arrangement with the committee at time of registration. (Guests provide their own transportation.)

*General Electric Company, Riverworks, Lynn. Trip—*Wednesday afternoon.* Turbines, street lights and motors; mercury boiler installation.

Edgar Station, Edison Electric Illuminating Co. of Boston, Weymouth. Trip—*Thursday afternoon.* 120,000 k-va. steam power station; first 1400 lb. pressure station.

*Charlestown Navy Yard. Trip—*Friday afternoon.* Ship repair and construction; the frigate Constitution.

Lever Brothers Company, Cambridge, soap manufacturers.

American Sugar Refining Company, Boston. Trip—*Tuesday, Wednesday or Thursday, 1:30 p.m.* The complete refinery process may be seen.

Arthur D. Little, Inc., Cambridge. Research chemists.

Boston Woven Hose and Rubber Company, Cambridge. Rubber products, tape, hose, etc.

The following are open to visitors, some conducting regular guided trips as indicated:

Ford Motor Car Company, Somerville, 9, 10, 11 A.M.; 1, 2, 3 P.M. Assembly of cars and trucks.

Boston Public Library, Copley Square, Boston. One of the notable architectural monuments of America. Mural decorations by John S. Sargent, Edwin A. Abbey, and Puvis de Chavannes. Oldest free library maintained by taxation in any city of the world.

Art Museum, Huntington Ave. Collection of ancient and modern art. Ranks among the most important art museums of the world.

Natural History Museum, Berkeley Street, corner of Boylston Street, Boston.

Old State House, State Street and Devonshire Street. Built in 1748. Restored in part as it was in Colonial days. Contains many interesting exhibits, including Franklin's printing press.

Bunker Hill Monument, Breed's Hill, Charlestown. Built 1825–1842 to commemorate the Battle of Bunker Hill.

Christian Science Publishing Co., Boston, every half hour 9 to 11:30 A.M. and 1 to 4 P.M. daily. Book and newspaper publishing. The mapparium-spherical room showing map of world.

* Visitors must be United States Citizens.

THE CAMBRIDGE MEETING OF 1937

By H. P. HAMMOND

President of the Society

In helping to plan a convention of this Society one finds that he may acquire a background of vicarious experience by examining the record of former meetings. And there are important by-products of this process, especially when past meetings have been held at the same site and thus furnish points of reference and comparison. One is struck, for example, immediately and forcibly by the contrast between the magnitude of past and present meetings, and he is thus led to ponder on growth and development in engineering education and in engineering itself, of which changes in the size and nature of our meetings are something of an index.

It happens, this year, that we return to the place of two previous annual conventions—those of 1898 and 1912—as well as that of the special mid-winter meeting of 1918. It may be interesting, therefore, before discussing plans for the meeting of 1937, to review some of the simpler facts concerning these earlier conventions.

In 1898, when the first Boston meeting was held (with Massachusetts Institute of Technology as host) the Society, then in its fourth year, numbered 226 members, almost precisely the same as the number of new members elected last year. Sixty nine members and guests were in attendance at the convention, which was held during August immediately preceding that of the older and stronger American Association for the Advancement of Science. President John B. Johnson's formal address was devoted to the thesis that "a specific scientific training for the direction of each and every kind of manufacturing and commercial activity" was an essential condition to our future material prosperity.

By 1912, when the second Boston meeting was held (with sessions at Harvard, Massachusetts Institute of Technology, and Wentworth Institute) the Society was strong enough to hold its meeting independently of any other association; membership had increased to 1,102; and there were 215 members and guests in attendance—"the largest attendance at any of the Society's conventions." A portion of the program was devoted to four simultaneous divisional meetings, a forerunner, in a small way, of our present conference sessions.

The meeting of December, 1918, also held in Boston, was a special session, in addition to the regular annual convention and need not here concern us.

From 1912 to 1936, during which period memberships in the Society had approximately doubled, attendance at the annual convention had increased six-fold, to a total of 1,200, and the convention programs had grown in complexity and diversity to at least as great a degree. Vitality and usefulness have been attributes of this Society since its earliest days, but it is chiefly in the recent past that its activities, and especially attendance at its meetings, has enlisted the participation of such a large proportion of its members. The "Conference Plan" of separate sessions of divisions and committees is largely responsible for this striking growth of our convention programs.

This plan is to underlie the program of this year's meeting, which is to be preceded by two "summer conferences"—direct descendents of our recent summer schools—on civil engineering and mechanical engineering. Among other conferences of special importance this year are the meeting of the mineral technology group having as its principal purpose discussion of the formation of a Division of the Society better to provide for the interests of those concerned in mining, metallurgy, ceramics, petroleum production, geology and other divisions of this field; a special meeting of the Committee on English at which plans will be formulated for the proposed comprehensive study of methods of teaching English to engineering students; and a joint session on engineering economy which is to be held at Cambridge immediately following the Society's Summer School for Teachers of Economics which is to be held under the sponsorship of Stevens Institute of Technology at its camp at Johnsonburg, New Jersey. These and the numerous other special meetings and conferences are to occupy two full days preceding the convention as well as two half days during the convention itself. They will afford opportunity for the individual participation of every person attending the convention.

The program of the general sessions of the convention, occupying one full day and two half days in addition to the two evening affairs (concert and annual dinner), is to continue along the same general line as that of the Madison meeting of last year which was devoted to one phase of the problems of the personnel of engineering education—the student. This year's program will have as its theme "The Engineering Teacher." The program, as printed elsewhere in this issue, provides a varied sequence of topics relating to this central theme and its numerous ramifications.

Our hosts—Harvard and Massachusetts Institute of Technology —with the cooperation of neighboring institutions, have made most

admirably thorough and complete preparations for our comfort and pleasure, including as a not inconsiderable item a complimentary "Pops Concert" of the Boston Symphony Orchestra. The facilities for meetings provided by the two great institutions are admirable. It may be said without the slightest exaggeration that New England in summer is one of the most delightful vacation and touring lands in the world, and Boston itself and its environs is not only filled with points of historic interest but also offers, by reason of its situation on the sea coast, opportunity for a great variety of diversion and recreation. A trip to Cambridge and the convention promises to be one of the most profitable and pleasurable experiences to which one could look forward!

NEW ENGLAND—VACATIONLAND

By CHESTER L. DAWES

Associate Professor of Electrical Engineering, Harvard University

When those attending the S. P. E. E. Convention at Cambridge this coming June cross the New England frontier, they are entering thirty-six thousand square miles of vacationland, a region that has many historical associations dating from the earliest days of the American colonies, through the Revolution, and down to the present time. There is no other region in the United States which combines in so great a measure the diversified recreational opportunities of oceans, mountains, rivers and lakes, with historic shrines marking the beginning of our American Republic. If one is eager for the seashore, there are 2,500 miles of seacoast combining long stretches of sand and surf with sheltered bays and inlets; if mountain scenery and mountain climbing appeal, there are the rugged Green Mountains of Vermont, the famous White Mountains and Mt. Monadnock of New Hampshire, Katahdin and Cadillac of Maine Wachusett, Greylock and the Berkshires of Massachusetts, and the famous Litchfield Hills of Connecticut; if one enjoys the pleasures of lakes and rivers, such as fishing, boating and swimming, many opportunities exist throughout New England and particularly in Maine, Vermont and New Hampshire.

For golf, New England has more than 600 courses which stay green during the entire summer. As for tennis, there is scarcely a resort that does not have its tennis courts available for guests.

Entering New England

New England may be entered by numerous through auto routes, coming from either New York or Canada. Practically all the roads, including the connecting roads, are improved roads, and on the through routes are many superhighways. The character of the New England countryside is varied with small areas of flat terrain, open valleys, and roads winding among the hills. In fact, when driving there is always the thrill that comes from the unexpected beauty spot over the next hill.

Entering from southern New York, U. S. Route 1, along Long Island Sound, is the most direct. This route may be followed through New Haven, the home of Yale University, the historic towns of Saybrook and Old Lyme at the mouth of the Connecticut

River, to Westerly, Providence, and along a superhighway to Boston. An alternate and possibly shorter and more varied route is to leave Route 1 at New Haven and take Route 15 to Middletown, the home of Wesleyan College, then to East Hartford, Stafford Springs, Sturbridge, and along Route 20 (a superhighway) to Boston.

Those crossing the Hudson at Bear Mountain Bridge or Poughkeepsie may take Route 6 through Danbury to Hartford, and Route 15 to Sturbridge and Route 20 (superhighway) to Boston. A delightful drive, however, for those crossing the Hudson at either Bear Mountain, Poughkeepsie or Kingston, is through the beautiful Litchfield Hills of Connecticut, including the town of Litchfield or Goshen, then proceeding to Hartford. Crossing at Catskill or at Albany, one may drive through the lovely Berkshire Hills of Massachusetts, through Great Barrington, Stockbridge and Lenox, or Pittsfield and Lee, thence over Jacob's Ladder, with an observation tower at the top, down the Westfield Valley to Springfield, and along Route 20 to Boston. An alternate route is from Albany to Troy, thence over the scenic Taconic Trail to Williamstown, the home of Williams College, thence over the famous Mohawk Trail (Route 2) down the Deerfield River to Greenfield, continuing over Route 2 to Boston.

If one enters New England through southern Vermont, he may take Route 9 through the historic town of Bennington, where the 302-foot monument (the highest battle monument in the world) commemorates the battle which was probably the turning point of the American Revolution. Here it was that the renowned John Stark and his Green Mountain Boys in August, 1777, overwhelmed General Burgoyne's British troops. A very pleasant ride is to continue to Brattleboro, down the west side of the Connecticut River to Vernon, where a hydroelectric plant of the New England Power Association may be seen, thence to Northfield, the home of the Moody Seminary for girls and Mt. Hermon School for boys, both founded by Dwight L. Moody. Route 2 may then be taken to Boston.

The routes entering through northern Vermont offer many scenes of interest and beauty. The International Highway (Route 2) may be taken through Montpelier, the capital, and possibly to Barre. Either Route 12 or 14 may be taken to White River Junction, near Hanover and Dartmouth College, through Canaan to the Daniel Webster Highway (Route 3) to Boston. An alternate route is from Burlington to Rutland, Chester, Bellows Falls, and along Routes 12 and 2 to Boston.

Our Canadian friends may enter at several points along the border such as Rouses Point, New York, then over to St. Albans,

Vermont; or they may enter at Richford, North Troy, or Newport, Vermont. Another delightful tour is to enter on Route 201, going down through Jackman, Maine, Skowhegan, Augusta, Brunswick, along Route 1 to Boston.

Recreational Suggestions

Picturesque Cape Cod

Cape Cod is an outwash plain curved into the Atlantic Ocean and was settled by the Pilgrims almost as soon as Plymouth. It has been inhabited by their descendants ever since, and still retains much of the early Colonial atmosphere. The Cape really begins at Sagamore and Bourne, at the Cape Cod Canal, and extends to Provincetown, the first landing place of the Pilgrims, commemorated by the Pilgrim Shaft, an outstanding landmark. The Cape is a land of forests, farms, lakes, elm-shaded villages, and small harbors. Its air is rich with ocean salt and the smell of pine woods. It appeals to the fisherman, the yachtsman, the swimmer, the golfer, the tramper, the horseback rider, the picnicker, the photographer, and the collector of antiques. With sandy beaches and water of attractive temperature, the bathing is delightful. Facilities are available for campers and for hikers. From Truro to Provincetown the Cape consists mostly of sand and sand dunes. With its old towns and little gray houses along the shore, the charm of early America is retained in Cape Cod even today.

New England's Shore Line

No visitor to New England should leave without becoming acquainted with the New England seaside extending along Long Island Sound, Cape Cod, and along the coasts of Massachusetts, New Hampshire and Maine. The shore is of varied character, with long stretches of flat sandy beach and surf, with bays, inlets, tide rips and exposed granite cliffs, against which the dashing waves break into foam.

An excellent trip is along the Massachusetts North Shore to Marblehead, Gloucester, Rockport, Newburyport, and then along Route U. S. 1 up the New Hampshire and Maine coasts. By turning east at Salisbury, one drives along the shore at Salisbury Beach, over the longest bridge in the world, to Hampton Beach, Rye Beach, and to Portsmouth, New Hampshire. The famous Colonial houses and doors at Portsmouth should be seen. At York, Maine, a similar detour takes one along York Beach; Ogunquit is the summer home of many writers and artists, and here is also the Manhattan Theater Colony. Kennebunkport is the summer home of Booth Tarkington. At Saco one may detour eastward to Old Orchard

ALONG THE WATERFRONT AT GLOUCESTER

Beach. Then at Portland, the birthplace of Longfellow, one finds the Eastern and Western Promenades and has access to Portland Harbor and Casco Bay, with all its rocky, spruce-covered islands. A tour of Casco Bay may be made at reasonable cost on any of the small boats which ply around the bay. Not far off is Brunswick,

the home of Bowdoin College. The coast is studded with well-known resorts, such as South Harpswell, Popham Beach, Wiscasset, Boothbay Harbor, Cape Newagen, Pemaquid (with the restored tower of Fort William Henry), Christmas Cove, and Thomaston. In Wiscasset one should note particularly the old Colonial houses and their artistic doorways, and one should certainly see the General Knox House at Thomaston. The route continues to Rockland, Camden (with the Camden Hills), Penobscot Bay, across the Bucksport Bridge to Ellsworth, and Mt. Desert Island, with Bar Harbor and Mt. Cadillac in Acadia National Park.

Mt. Desert Island, only 10 miles from Ellsworth, is considered one of America's most beautiful and spectacular regions. In it is included Acadia National Park, consisting of 15,000 acres of ocean, woodland, lakes and mountains. It is said that except for Rio de Janeiro, there is no spot on the Atlantic seaboard possessing similar scenery. Cadillac Mt. (1,523 ft.) is the highest of the mountains, and there is an excellent automobile road to the summit. The summit is the highest point of land on the Atlantic coast and the view includes miles of panorama of ocean, rugged coast line, and mountains. Guests attending the S. P. E. E. Convention should certainly visit Mt. Desert Island and Mt. Cadillac. On the Island there is also Bar Harbor, the famous summer resort on island-dotted Frenchman's Bay, Northeast Harbor, and Southwest Harbor. The shore drive between Bar Harbor and Northeast Harbor is an unusually beautiful one, over granite cliffs with breaking waves.

East Machias is about 120 miles from Ellsworth, and six miles beyond East Machias, on Lake Gardner, is the M. I. T. Engineering Camp. Although not open until July 26th, the caretaker will be glad to show visitors about.

At Calais one can cross the St. Croix River into New Brunswick, from which good roads lead to Nova Scotia and other Canadian Provinces, and to the famous Gaspé Peninsula.

No visitor to New England should leave without having partaken of at least one "shore dinner" of which the clam and the lobster are the chef's "pièce de résistance."

New Hampshire and the White Mountains

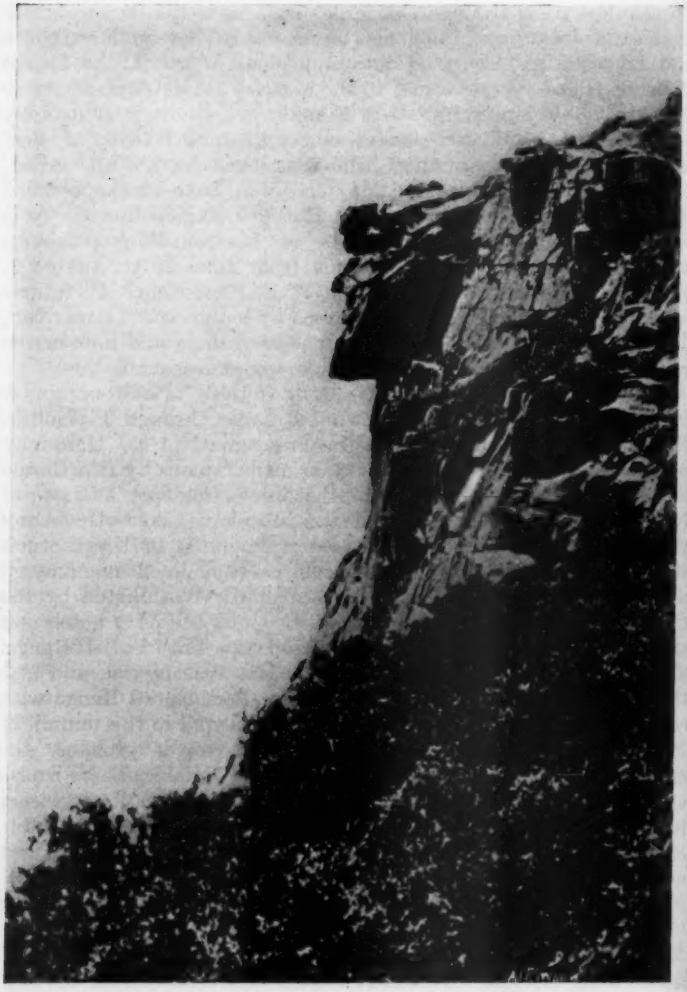
New Hampshire, which claims to be air-conditioned by nature, is best known for its White Mountains, which include Mt. Washington, the highest peak in New England (6,288 ft.), and the rest of the famous Presidential Range, as well as beautiful Lake Winnepesaukee. Moreover, the charm of the White Mountain region is enhanced by the many island-studded lakes among the surrounding foothills. To reach the White Mountains, one takes Route 3 from

Cambridge, going through Concord, the scene of the famous battle of the Revolution, and the homes of Emerson, Thoreau, Hawthorne and Louisa May Alcott. Continuing along Route 3, the Daniel Webster Highway, one comes to the home of Daniel Webster, near Franklin, New Hampshire. At Franklin an alternate route may be taken to Lake Winnepesaukee, one of the most beloved of vacation spots, where swimming, fishing and boating are unexcelled; continuing on to Ossipee and Mt. Chocorua, from its shape called the Matterhorn of America. The Harvard Engineering Camp is situated on the shore of Squam Lake, not far from Winnepesaukee, and the Camp will be in operation from June 26 to August 2. Professor Haertlein will welcome S. P. E. E. visitors. Directions for reaching the Camp may be obtained by inquiring at Garnet Inn, Center Harbor. There are many lakeside camps and inns in the vicinity of these lakes, where one may stay at reasonable cost.

From Franklin the more direct route to the White Mountains is to go along the shores of Newfound Lake through Plymouth, North Woodstock, and through the Franconia Notch. Here may be seen the Old Man of the Mountain made famous by Hawthorne in "The Great Stone Face." Another interesting spot is Crawford Notch, where the Willey landslide is said to have taken place many years ago. This disaster is also commemorated in Hawthorne's story, "The Great Carbuncle." From Bretton Woods one may go directly to the Base Station and ascend Mt. Washington by the Cog Railway, or he may go to one of the many camps or hotels and arrange to climb Mt. Washington and the Presidential Range. There are several trails to the top of Mt. Washington, and also there are numerous trails over the entire Presidential Range with comfortable huts at frequent intervals. The trail to the summit of Mt. Washington through Tuckerman's Ravine is probably the most popular one, and starts from Pinkham Notch. There is also an automobile road to the summit of Mt. Washington, if one wishes to drive up. North of the White Mountains is the Dixville Notch, extending from Colebrook down through Errol into Maine. There are many Appalachian Mountain Club trails through the White Mountains, and at frequent intervals are to be found Appalachian Club huts which accommodate the climbers and walkers. Mt. Monadnock, near Rindge, in southern New Hampshire, is only 90 miles from Boston. At Peterborough is an interesting art and literary colony sponsored by Mrs. Edward MacDowell, widow of the well-known composer.

Vermont and the Green Mountains

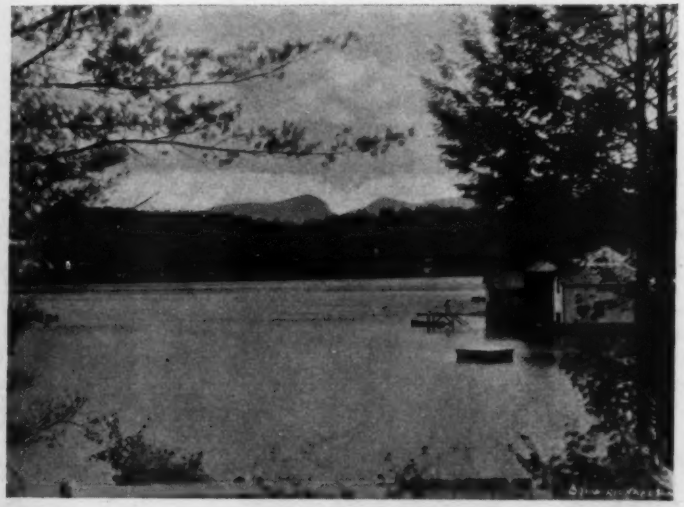
Vermont has been aptly described as "a continuous natural park." It is a state of mountains, and its people still typify the



OLD MAN OF THE MOUNTAINS, FRANCONIA NOTCH, WHITE MOUNTAINS, NEW HAMPSHIRE

sturdy individualism of Ethan Allen and his fellow colonists. The Green Mountain Range forms a skyline from Massachusetts to the Canadian border, and culminates in Mt. Mansfield (4,393 ft.),

Camel's Hump (4,083 ft.) and the surrounding mountains near Stowe and Waterbury. Thanks to the Green Mountain Club, there has been completed a 250-mile trail along the top of the range with 42 cabins and shelters along its length. The trail presents a wealth of distant views and is readily accessible at numerous points along the range. Burlington, which is on the shore of Lake Champlain and within a short distance of these mountains, is 223 miles from Boston, over excellent roads.



CANOE, ROWBOAT, OUTBOARD, OR SPEED CRAFT, ALL ARE AT HOME ON THE SMOOTH WATERS OF NEW ENGLAND LAKES. Forest-fringed Lake Bomoseen, surrounded by the mountains of western Vermont, is only one of 3,000 lakes in New England in which summer vacationists and fishermen find continual delight. (Photograph © by Richardson from the New England Council.)

Vermont is rich in lakes, ponds and streams, both in number and in beauty. Lake Champlain, which forms much of Vermont's western boundary, is the largest body of fresh water east of the Great Lakes. Other famed lakes are Memphremagog, at the Canadian border at Newport, and Willoughby, a few miles south, which reminds one of the lakes in the Swiss Alps. Among the other larger and better-known lakes are Seymour, Morley, Fairlee, Caspian, Dunmore, St. Catherine, and Bomoseen. These lakes, as well as many smaller ones, are found in charming mountain settings. Every facility for hotel or camp life, water sports, golf and tennis, as well as New England hospitality, are offered to the visitor.

Maine, the Pine Tree State

Maine is the largest of the New England states and its varied coast line has been described already. It has a vast and rugged interior, abounding in extensive forests, a great many lakes, streams, mountains, fish and game.

Mt. Katahdin (5,200 ft.), a few miles northwest of Millinocket, is set in an unspoiled wilderness of woods, lakes and streams, a nature lover's delight. The mountain is in the form of a jagged crescent,

THE ATLANTIC IN A SPIRITED MOMENT SENDS BREAKERS TO FLING THEIR SPRAY AROUND PORTLAND HEAD LIGHT, STANDING AS A BEACON TO GUIDE VESSELS INTO THE HARBOR OF PORTLAND, MAINE. This famous landmark, one of the first lighthouses to be erected on the Atlantic seaboard, also draws thousands of visitors every year. (Photograph © by Blood from the New England Council.)

and there are several trails to the top. Climbing is a delight to those who prefer the rugged and outdoor camping. On the way north to Millinocket, one usually goes through Bangor, and then Orono, nine miles away, the home of the University of Maine, and Dean Paul Cloke is always delighted to see visitors.

In northern Maine, an unspoiled wilderness, is Moosehead Lake, the largest body of fresh water within a single state, with its wooded islands, its bays, with excellent boating and fishing. Nearby to the west are the ponds at Jackman. Near Augusta are the Belgrade

Lakes, and to the west near the New Hampshire border are the Rangeley Lakes. Only 30 miles from Portland are Sebago Lake and Little Sebago Lake. There is not space to enumerate the numberless smaller lakes and streams which abound throughout Maine, but one finds them in every direction. There are always camps, hostelries and other recreational facilities to meet one's pocket book.

Summer Theaters

In New England there are numerous summer theaters, many of which have gained national reputation. A number of Broadway stars in the early days of their careers appeared on the stages of some of these theaters. Only this last season such well-known players as Jesse Royce Landis, Irene Bordoni, Mary Rogers, Ed Wynn, Keenan Wynn, Frances Starr, Florence Reed, Joanna Roos, Estelle Winwood, Margalo Gilmore, Anne Seymour, and many others of high reputation were acting in these playhouses.

Some of these theaters are: in Massachusetts, at Dennis, the Cape Playhouse; the Wharf Theater at Provincetown; the South Shore Players at Cohasset; the Berkshire Playhouse at Stockbridge; in Maine, the Manhattan Theater Colony at Ogunquit (75 miles from Boston on Route 1), Lakewood Theater (Skowhegan), and the Garrick Players in Kennebunkport (off Route 1); in New Hampshire, the Barnstormers at Tamworth, the Barn Playhouse at New London; in Connecticut, the Country Playhouse at Westport; the theater at Stony Creek; in Rhode Island, The Casino Theater at Newport.

Many of these theaters provide lodging, dining and recreational facilities. This is particularly true of Lakewood, 5 miles beyond Skowhegan, Maine, directly on Route 201 to Quebec. The colony is located on the shores of Lake Wesserunsett. In addition to a first-class theater, the colony is practically a summer resort. There are excellent bungalows, a first-class dining room, both at moderate prices, and facilities for boating, bathing, golf and tennis.

Note: Through the courtesy of the Boston Chamber of Commerce, as well as the New England Council, during the Convention there will be a representative at the registration desk at specified times, to tell visitors and delegates what to see in Greater Boston and New England, and also to assist them in planning trips; through the courtesy of the New England Council there will be booklets and literature describing resorts and places of interest in New England, as well as road maps and guide books.

TEACHING OF BASIC COURSES *

By PRESIDENT H. S. ROGERS

Polytechnic Institute of Brooklyn

In the consideration of objectives and methods of instruction in civil engineering courses, certain fundamental characteristics of courses and procedures must be recognized and certain definitions established. In a paper presented before this section last year the courses in civil engineering were somewhat arbitrarily divided into various types such as, basic, applied, informational, and manipulative. For the purpose of this paper it is desirable to define the term "basic courses" somewhat more sharply and to describe the limitations somewhat arbitrarily thrown around the use of the term.

The text-books of to-day and the form of organized courses are the heritage of the thinking of our predecessors and their recognition of certain related and original principles in fields of engineering thought; they provide the basis for a classification of courses. In the use of the term, basic courses, I have, therefore, in mind text-books and courses—since these are more or less coextensive in their subject matter—which are more or less common to civil engineering curricula and which deal with elemental forces and reactions, with motions of solids and liquids, and with the properties of engineering materials. The term is used without particular intention to designate the course in physics ordinarily given to freshmen or sophomores or the usual courses in engineering mathematics. Many of the points which are considered, however, will apply equally well to physics and mathematics.

Those courses of the civil engineering curriculum which will be included under the term basic courses may be considered as immediate extensions of certain phases of physics which have been developed under the motive of application in engineering problems. They are: mechanics, hydraulics, strength of materials, and elementary structural analysis. To this group might be added materials of engineering. It is, however, of such a nature that the methods of instruction involved may be considered more accurately as distinctive of this particular course.

In the intent to establish a concept of the term, basic courses, it must be recognized that no course is exclusively basic or funda-

* Presented at Civil Engineering Division Conference, Madison Meeting, S. P. E. E., June 1936.

mentally abstract. While a course like mechanics may be elemental and basic in the training of a civil engineer, certain applications of principles in it to practical conditions are necessary and desirable. Basic courses may, however, be differentiated from applied and informational courses by their major emphasis upon principles and elements.

Organization of Basic Subjects

Basic subjects are uniformly organized about the logical and systematic study and consideration of the principles involved in some fundamental field of thought. Writers upon and teachers of mechanics, after establishing definitions of units and introducing elemental principles, ordinarily take up a consideration of parallel coplanar forces and moments, then centers of gravity followed by non-parallel coplanar forces; next they consider the concepts of friction, and the elementary concepts of rectilinear and rotary motion, then units of measurement of force and mass; after which they combine these principles for the study of kinetics of bodies under uniform and variable rectilinear motion, and under uniform and non-uniform rotation. They continue with a consideration of work, energy, power, momentum, impulse, and impact.

The study of hydraulics deals with and is organized about hydrostatics, hydrokinetics, and hydrodynamics. Hydrostatics includes a study of intensity of pressure at a point and of total pressure on an area, together with the principles of buoyancy and of equilibrium of liquids. Hydrokinetics establishes certain definitions and general principles, and covers the movement of water through various apertures and channels. Hydrodynamics considers the forces of moving water upon fixed and moving surfaces. Strength of materials ordinarily covers the elemental study of stresses and strains, fundamental theories of flexure, torsion and column action, and derived principles for determining reactions, shears, moments and deflections. So each of the subjects which we may choose to call basic is organized around the consideration of abstract and general principles expressing the relationships between certain elemental physical phenomena.

Nature of Basic Principles

The principles fundamental to basic subjects may be considered generic in so far as they are characterized by general applicability to a wide variety of engineering problems in a definite field, and in so far as they rest upon certain fundamental physical concepts which form the basis of this wide application. The foundation of

a critical understanding of basic subjects must be built upon these physical concepts and a mastery of generic principles. Generic principles may be classified in three categories, rational facts, hypotheses, and empirical facts. Such concepts as the laws of equilibrium, the law of conservation of energy, and the law of conservation of matter, represent typical examples of rational facts. At least, the engineer accepts them as such in his work. Such assumptions as "a plane section before bending remains plane after bending," as the distribution of velocities in the theoretical flow over weirs, or as the distribution of earth pressures behind retaining walls, are characteristic examples of hypotheses. Such data as the stresses which materials will carry at the elastic limit or at the ultimate limit, as the coefficients of discharge over weirs, as the coefficients of friction between materials, or as the hardness numbers of metals are typical examples of empirical facts.

Basic courses are confined largely to the elementary study of these generic principles and their purpose is the development of a critical understanding of principles which may be used as working tools. One of the principal differences between basic subjects and applied subjects lies in the contrast between emphasis upon generic and derived principles and upon procedures. In the applied subjects many derived principles are developed for the purpose of contributing facility in the solution of more or less standard problems. Applied subjects are, therefore, characterized by standard practices, codified specifications, and current procedures, while the critical study of basic principles, on the other hand, characterizes basic courses.

Objectives of Instruction in Basic Courses

It is impossible for one specifically to discuss objectives of instruction without definitely limiting the discussions to certain issues under consideration. There are so many purposes of instruction that are attendant upon all classroom practices that perhaps some should be more or less categorically set aside. Engineering discipline for the purpose of developing industry, accuracy, thoroughness, and neatness, may quite naturally characterize all engineering courses. Facility and accuracy in algebraic and graphic expression and composition might characterize certain courses. Other general objectives such as the awakening of professional consciousness or the development of personality and character, might furthermore be included in any course. The characteristic, specific, and definite objectives of basic courses are, however, the development of a critical mastery of generic principles and of the power of constructive thought which find expression in

the application of principles to the solution of engineering problems. These should command the major attention of all instruction in basic courses.

Mastery of Basic Principles

The effective development of critical mastery depends upon a clear comprehension of the nature, the derivation and the limitation of all generic principles. The principles, both fundamental and derived, of basic courses while abstract in their nature and in their form of expression are, nevertheless, firmly founded upon physical concepts of forces and movements and upon certain logical methods of analysis. They may become the working instruments for independent engineering thought or for creative engineering applications only through the critical mastery of these physical concepts * and rational analyses.

The introduction and presentation of rational facts and physical concepts by the instructor is one of the most important phases of his work. Such concepts, for example, as the "sum of the forces acting in any direction upon a body in equilibrium is zero," should be made through specific and concrete cases with recognition of the fact that only in this manner can the generalized idea be developed.†

The physical phenomena which are abstractly conceived as rational facts in engineering thought are frequently supplemented by hypotheses of more or less degrees of accuracy. Such an hypothesis as that of a plane section in a beam remaining plane under flexure is only approximate and limited to very specific conditions. The origin and limitations of all such hypotheses must be specifically understood for the sound development of critical thought. An hypothesis such as the distribution of velocities in flow over a weir under the basic law of conservation of energy is merely a rationalized case and is worthless unless it bears some definite relationship to actual conditions. Each hypothesis has its peculiar limitations and is utilized for its specific purpose.

Abstract physical principles and hypotheses are also supplemented in the solution of engineering problems by certain empirical facts such as the modulus of elasticity of materials, such as the

* It is in the describing and development of these physical concepts that educational psychology can be of particular aid to us. The terms percept, concept, and apperception which have been carefully defined by psychologists here are directly applicable. The concept of the balance of forces upon a body in equilibrium is a prototype of the definition.

† The introduction of the concrete before the abstract is one of the tenets of good pedagogy. In all such introductions the concrete presentation should be made specifically upon the apperceptive background of the students.

safe design stresses and ultimate stresses, such as the coefficients of friction, discharge and contraction in hydraulics; they should be thoroughly understood in character, source, and accuracy, and knowingly differentiated from the hypotheses and the rational facts with which they are combined in the derivation of working principles by mathematical operations.

There are certain aids which have been developed in the course of years for the study and presentation of physical concepts such as the graphical methods of analysis for direct stresses; such as free body sketches; such as solids of pressure, of stress, and of flow; such as elastic models, and, more recently, the methods and results of photoelasticity. Free body sketches and graphical methods have perhaps been used more generally as aids in building physical concepts than, for example, solids of pressure have been used in hydraulics or in studies of earth pressure, or than solids of stress depicting internal distribution of stresses have been used in structural members.

In my own teaching of hydraulics I have used a "solid of flow" for the purpose of presenting the hypotheses underlying the theoretical flow over weirs and for the purpose of crystallizing the physical concepts involved. (Illustrated on blackboard for flow over weir.)

The new methods of structural analysis applying the principles of similitude, or improvised methods using elastic frames of wire, the model studies in hydraulics, and the photoelastic equipment are contributing much to help the student in the mastery and understanding of physical concepts. It is certain that we can hardly go too far in these fields if we desire to develop true critical understanding and avoid the training of handbook engineers.

Certain obstacles in the development of physical concepts, on the other hand, creep into our teaching. Among these is the use of historical labels done not without generosity and appreciation of the work of some scientist or engineer, but very frequently at the expense of clear understanding. Torricelli's theorem of flow through an orifice is, of course, the same as Bernoulli's, but both are more descriptively presented to undergraduates as illustrations of the law of conservation of energy. The use of calculus in the study of internal shear on an infinitesimal unit of a beam is not, I am afraid, very enlightening to a student who discovers it in this dress.

Now I imagine I hear some protests on that score because the application of the calculus to the study of internal shear may give a more exact and a more generalized understanding provided, however, the student has a true critical understanding of his calculus. It is my conviction that few students at the junior level have such

an understanding. A free body of unit length cut transversely from the beam with all normal and tangential stresses shown affords a better way to develop the physical concepts of internal shear than the usual method of development with the calculus. The critical mastery of principles involved in internal shear cannot be developed or possessed except upon the sound foundation of physical concepts, a critical knowledge of the hypotheses utilized and an understanding of the nature, origin and limitation of empirical facts and every effort to make these clear should be made by the instructor.

There are certain definite stages or levels marking progress toward critical mastery that may be identified. They are not built successively like the stories of a building but they proceed without break more like the passing from night to day. Any definition of them must, of course, be relative, but it seems to me these stages can be roughly identified. The first is cognition which, for example, may describe the level of understanding of a sophomore or a junior who has had the principle that the sum of the forces acting in one direction upon a body in equilibrium equals the sum of the forces acting in the opposite direction explained to him. Appreciation is next and represents the level of understanding and confidence of the student who has repeatedly used this principle and begins to feel assurance in its use. Critical understanding, another relative term, marks the third and higher level at which the possessor is aware in all respects of the facts and the manner in which this same principle is applied in the solution of manifold engineering problems. The final stage for the engineer is marked by facility in constructive use. The physicist may develop a high critical understanding of the principles of mechanics without appreciation of the constructive use to which the engineer applies these principles. The engineer's knowledge must, however, go beyond critical understanding to the mastery of constructive use; this mastery is built up in consecutive stages from cognition, through appreciation, through critical understanding, to constructive use.

The objectives of basic courses aim more particularly at critical understanding than at constructive use, consequently these courses appear very largely in the junior year of the curriculum. In the senior year, the emphasis is placed upon constructive use in the applied courses, and facility in application to standard problems becomes one of the major objectives of these. Critical mastery may not, however, be separated from facility in constructive use, but grows quite definitely with it and in the last analysis is measured by facility in application to the solution of *new* problems. The critical mastery developed, therefore, in basic courses is of an ele-

mentary nature, but should serve as the foundation for advanced application.

Methods of Instruction in Basic Courses

There is no one certain avenue by which the teacher may lead from introduction, or the student may go from cognition, to critical understanding of the fundamental principles of basic courses, but, nevertheless, there are again certain definite milestones marking this progress. These milestones are discovery, proof, generalization, and fixation.

The apprehension of an abstract principle such as those underlying mechanics, hydraulics, and strength of materials is, first of all, essentially a discovery and as such involves inductive thinking, perhaps under the guidance of the instructor, but certainly not without the apperception of the student. This inductive thought and discovery for the student is most effectively made by a skillful introduction of the subject through specific and concrete examples on the part of the teacher. The introduction may be followed then by assignment in which the student may apply the principle to the proof of various problems through the processes of deductive thought. Through the use of elemental principles he will advance to the level of appreciation or confidence. This is very frequently as far as instructors may go, but the goal of true critical understanding and appreciation of the generic nature of principles demands something further in the nature of review.

It is a very instructive process to take a class at the completion of the study, say, of hydrostatics with all of their problem papers before them, and step to the board to record the generic principles of hydraulics which have been used in the solution of the first problem, then to list in order or to record under those already listed the principles which have been used in all problems. The class is usually amazed by the small number of these. This review again should be carried on as inductive thinking through which the generalization made by the comparison of problems leads quite definitely to sound critical understanding of principles. If time permits, a fourth period of drill for the purpose of fixing principles in mind may profitably be added.

This method of teaching is, I believe, sound and is effective in all basic courses. It will be noted that the discovery through cognition and the generalization in review are both phases of learning in which the type of thought is predominantly inductive. It is here the instructor can be most helpful, and the skill with which he leads the student to discovery and generalization has a significant influence upon the level of critical mastery which the student will possess at the completion of his course.

In summarizing may I say, that the critical mastery of basic courses and the power of constructive thought through which basic principles may be applied is solidly founded only upon a full critical understanding of the nature, the development, and the limitations of the rational facts, of the hypotheses, and of the empirical facts of basic subjects in definite terms of physical concepts; that the aids to the development of physical concepts should be more carefully and generally used; and finally that the progress toward critical mastery should be through discovery, proof, and generalization under the leadership of the instructor in introduction, assignment, and review.

ENDURING VALUES IN ENGINEERING EDUCATION *

By GILBERT E. DOAN

Professor of Metallurgical Engineering, Lehigh University

When we as an engineering society ask an industrial leader what he thinks we should teach in the field of engineering, we sit with attentive minds, eager to get a constructive suggestion from his talk. When we are advised, as frequently happens, to teach less of the engineering subjects to undergraduates, so that the boys may not be robbed of their chances to get a liberal education while at college, naturally we do not like his advice. If the oracle had asked for a course in the newest specialty of our field, or even if he had merely asked for more effective teaching of the standard engineering subjects, we would be delighted to accept his suggestions, and earnest in our efforts to profit by them. But when he says, "You now teach too much engineering technology to undergraduates. It prevents them from developing broad foundations such as engineers need in the service of industry," then we console ourselves by thinking, "Of course the man does not really know what he is talking about. He has gotten too far ahead in his profession to know what is actually going on in the engineering phases of his projects. If he realized what new developments there are in flotation and welding and air conditioning, he would want all his young engineers trained in these fields before they leave college. So we shall just discount what he has said to us today so vaguely and so pompously about the value of the fundamentals of science and the usefulness of the humanities in this grimly competitive life, and we shall continue to teach just exactly what we are teaching now, only more of it and by better methods."

Actually, that is what we have done. The S. P. E. E. study made in 1929 showed that in five schools (which they considered as representative of the engineering institutions of the country), 55 to 60 per cent of the student's time was spent on technology; 30 to 35 per cent on fundamental science, and 13 per cent on humanistic subject matter. There has been little change in these schools up to the beginning of the present academic year, when M. I. T. took a bold step to remedy the unbalance.

Like many of you, I too have spent twenty years of my life studying engineering and practicing it in industry, teaching it,

* Paper presented before the Mineral Industry Education Division, A. I. M. & M. E., Feb. 18, 1937.

researching in it, and writing about it, not always without significant results. I am impressed with the high value of its contributions to the development of civilization. Like you, I have a vested interest in engineering, from which I hope to continue to receive profits if not extra dividends. But I am here to sound a warning that if we are continuously unwilling to see technology in its proper relationship to the other essentials of undergraduate education, if we continue as we are now doing, to give too much technology and too little liberal education to engineering students, the investment of out lives in engineering education will shrink visibly in value and in returns. Either our engineering enrollments will drop in size and quality, or else some super-departmental power will arbitrarily reduce the amount of technology we are permitted to give our undergraduate students, thus putting us definitely out of our respected positions as educators and into the position of narrow technologists, if not teachers of vocations. I hope we shall take the initiative into our own hands. I believe we shall.

Very briefly I shall give you my reasons for believing that engineering curricula must contain more of the permanent values of education. I shall not advance my personal opinions, but rather I shall attempt to sense and to reflect for you the convictions of the groups most vitally concerned in engineering education, namely, first, the alumni, second, the industry that employs them, third, the leaders of engineering education, fourth, the leaders of general education, and fifth, the national government. First, and very briefly, let us look at the opinions of the recognized leaders of engineering education.

W. E. Wickenden, the director of that recent monumental survey of engineering education on two continents, pointed out * at its conclusion that but 19 hours of humanistic work were required on the average at the engineering schools which he considered representative: M. I. T., Cornell, Penn State, Purdue, and Wisconsin. In 144 hours total, this is 13 per cent. Wickenden suggested raising it to 17 per cent by running an integrated band "of three hours of humanistic courses throughout the entire four years." This suggestion was made prior to the social and economic crisis of 1929–32. To-day Wickenden appears as a prophet among us.

Karl T. Compton, President of M. I. T., says, "I believe that our criteria for real engineering schools should include the best possible basic training in the sciences and fundamental engineering subjects, with some specialization, and with very considerable attention to the place and the problems of the engineer in society." †

* Jour. Eng. Ed., Vol. 17, 1926–27, p. 797.
† Jour. of Eng. Ed., Vol. XXIII, No. 2, Oct. 1932, p. 75.

And he meant it, because M. I. T. this year adopted the Wickenden suggestions that I have just read to you.

In 1934 R. E. Doherty wrote, "It seems to me that these S. P. E. E. recommendations are sound, as far as they go, and also that it is quite possible that a more active and general recognition of them might have placed engineering education in a more appropriate position than it now occupies." He amplified his meaning as follows: "The educational importance of lifting the incubus of specialized undergraduate courses cannot be over-emphasized." Dr. Doherty is a man with an excellent professional experience with the Steinmetz group in industry, and is now President of Carnegie Insitute of Technology. "One of the greatest deficiencies of engineering courses in this country, in my opinion, has been the lack of cultural balance. Where such a balance has not existed, the student's intellect has been literally starved for the vitamins of human appreciation, thus leaving him with what might be called technical rickets—a wooden interest in matters outside his technical field." *

These opinions indicate a truly remarkable unanimity and depth of conviction among the recognized leaders of engineering education. They are not snap decisions but, dating from 1927 to 1937, they bridge the greatest social and economic upheaval of our times.

Now let us glance at the opinions of the country's industrial leaders. Perhaps the leaders of engineering education have somewhere gone astray. Perhaps, contrary to the opinions of the leaders of engineering education, what industry really wants is a maximum of technical training in our graduates, whether they are soundly educated or not.

To find out what the top executives at General Motors thought about it, Mr. Glancy, a Vice-President, made a careful canvass. His report says, "To a man the motor executives did not see the need of a boy's specializing, not even in gasoline engine design—not because his designs would be obsolete by the time he graduates, but because our greater need is for a complete grounding in the fundamentals."

Mr. Carrier, President of the air conditioning company of that name, answered a Lehigh student's inquiry recently by saying, "By no means should you study air conditioning at Lehigh if you intend to enter that field on graduation, but rather you should study the fundamentals on which air conditioning is based."

Mr. Sloan, Chairman of the Board of the Missouri, Kansas, and Texas Railroad, is even more emphatic. He says, "Many technical graduates are the victims of an over-intensified technical training

* JOUR. ENG. ED., Sept., 1934, p. 35.

which drove out of them, or failed to develop in them, other elements essential to a proper use of technical education, essential to continued and progressive usefulness in an organization where technical men are only a part of the whole. Industry wants men with a background and education broad enough so that technical training assumes its proper place but does not become the whole." Mr. Sloan was formerly President of the Brooklyn Edison Company.

I could add to this list, as you could, with Willis R. Whitney, R. I. Rees, and many others, all with this conviction deep-seated in their minds as a result of their own experiences in industry.

Even when a successful specialist is invited by his alma mater to come back to the campus and tell the undergraduates how to build a successful career, does he say, "Get all the technical specialties you can while at college"? Or does he put the force of his entire personality into his emphasis upon the need for men with a grasp of the fundamentals of science and the humanities. Does he say, "Specialize at college," or does he say, "Get the permanent values at college and specialize *after* college"?

The next group, the scholars and educational leaders, we can pass with hardly a word. Jessup, Head of the Carnegie Foundation for the Advancement of Teaching, Flexner of the Institute for Advanced Study, Hutchins of Chicago, the Lowell Medical Commission, all speak with a single voice in earnest petition for delayed specialization, for a solid foundation of the permanent values first.

What do the alumni of our engineering colleges say about the curriculum in which they spent four years? If you will ask them occasionally (assuring them first that you are able to look objectively at the importance of your own specialty), you can easily find their true opinion. They will tell you that after they have had one or two promotions, they find three-fourths of their problems and responsibilities are humanistic—non-technical. If this is true, can a boy afford to spend a large part of his four years at college preparing for the first five years in his profession? Or should a college education be expected to provide a foundation that will last a lifetime? The really successful engineers look back with regret at much of their specialization at college and at their lack of liberal viewpoint with which to meet their principal problems. Even in research and design the chances are that the so-called practical courses in technology are of relatively little use as compared with the fundamental courses in physics and chemistry. And we must not forget either that, according to President Compton, less than 50 per cent of our engineering graduates follow engineering as a life work. Should the other 50 per cent also be deprived of a chance at the permanent values in education?

Finally, as many of you are aware, the President of the United States and a group of his engineering advisers, in the recent vast conservation projects of national scope, is led to question in his letter to 100 presidents of institutions teaching engineering "whether the curricula of engineering schools are so balanced as to give coming generations of engineers the vision and flexible technical capacity necessary to meet the full range of engineering responsibility." This is the question we are met to consider. I will leave it with you to answer. Greater unanimity of opinion among the diverse groups concerned could scarcely be found on any question of urgent public importance. You have noted that it is not specialization that they object to but only *premature* specialization, accompanied by lack of grounding in the humanities. Perhaps it is true that the high schools should give this grounding as they do in Europe. *But what we face as engineering educators is an actual decision as to what the boys need most who come to us here and now.*

If the leaders of engineering education on the one hand and the leaders of industry on the other hand, the highly successful professional engineers, and the national government all petition for greater humanistic content and less special technology in engineering education, how can they possibly be denied, you ask me? The answer is a factual one. Those responsible for engineering curricula find that the majority of their students are sent to college by their parents for the purpose of learning a special skill, if not a vocation. The great majority of these parents have never been to college themselves. They have little or no background of judgment in planning their son's education. They have seen many successful specialists in their lifetimes and they want their sons to specialize. So they send him to a college that teaches plenty of specialties to undergraduates. Once at college, the aspiring boy meets an enthusiastic specialty teacher and almost at once becomes motivated by a zeal to master a restricted field and make his name and fortune in it. The teacher has devoted his own life to a specialty. He is proud of the advances in his field and proudly he lays before the boys' eyes the wonders of its achievements. The boys love it. They become enthusiastic. They work hard. They shut out all non-related interests, first by necessity of keeping up their grades, finally by lack of appreciation of the existence of other fields. What results could more surely warm the hearts and preserve the enrollments of the specialty teachers?

But when the boy graduates, what happens? Does he cling to his specialized career? Or does he almost as a matter of course take the best job he is offered—whether it is in his special field or not—in many cases, whether it is in engineering or not? His parents and oftentimes his teachers support him in his choice. He

may regret the bad investments he made in premature specialization which he did not follow, but it is too late now. Anyway, he saw the value of the courses he pursued at the time he was in college —even if they never were valuable to him. Why regret what happened in a period of his life that was enjoyable on the whole, anyway?

No one denies that there was *some* value in his enthusiastic pursuit of his specialty, even if he never met it once in his subsequent professional career. The objection that his future employers make is that this time would have been more profitably spent in learning to see his technical training in its proper background and perspective, in learning to understand the place and the problems of the engineer in society, as Compton puts it; in balancing his diet so that he can avoid technical rickets; in giving him a chance to develop "the vision and flexible technical capacity to meet the full range of engineering responsibility."

In the scope of this brief paper I shall not attempt to outline the means for developing this balance. The light cast upon our perennial human problems by the greatest minds of all ages as it shines forth from the classics of history, literature and philosophy, will indicate the trend of my thoughts, as well as those contained in the Wickenden suggestion and the M. I. T. move. Some men may be mere technicians by birth and unable to profit by anything but a vocational training. There should be and are schools in America for training boys of this type. But no capable engineering student should be denied a chance at the permanent values of true engineering education.

We have drifted comfortably alone. Enrollments have held up well. Most of the graduates have been too busy for retrospection. Industry has found the stiff engineering courses an effective screen to sift out those boys who could not pass hard exams. The industrial leaders have left the engineering schools alone to work out their own solution, considerately giving advice on educational programs only when they are specifically asked for it. But if engineering educators once realize, as I am sure they will, that the most valuable thing a boy can be offered in four years at college is the foundation of an education in science and the humanities, as contrasted with a specialized technical training, I know them well enough to feel sure that they will rise to the faithful discharge of that trust which parents and students have so solemnly imposed upon them.

With the most important groups thus unanimously behind the movement, I am confident that the viewpoints of the parents and of the boys themselves can be rapidly improved.

WHAT TRAINING IN GRAPHICS DOES INDUSTRY REQUIRE OF THE YOUNG ENGINEER? *

By A. S. LEVENS

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University of Minnesota

Last May a survey was made to obtain answers to the above stated question. Questionnaires were sent to two hundred companies, representative of various industries in the United States. Of this number ninety-two replied. The results of this survey are tabulated below.

	No. of Answers			
1. Does the young engineering draftsman make a clean-cut drawing?	77	Yes, 20 26.0%	No, 57 74.0%	
2. Is his line work good, fair or poor?	79	Good, 12 15.2%	Fair, 54 68.3%	Poor, 13 16.5%
3. Is his lettering good, fair or poor?	78	Good, 3 3.8%	Fair, 47 60.3%	Poor, 28 35.9%
4. Is he capable of making a fairly complicated drawing?	77	Yes, 19 24.7%	No, 58 75.3%	
5. Can he read a fairly complicated drawing?	77	Yes, 49 63.6%	No, 28 36.4%	
6. Do you believe that a one-year course in drawing (250 to 300 hours over a nine-month period) is ample?	80	Yes, 19 23.8%	No, 61 76.2%	
7. Do you believe that it is desirable to extend drawing instruction over a two-year or longer period?	77	Yes, 62 80.5%	No, 15 19.5%	
8. What in your opinion are the most apparent deficiencies of the young engineer who is employed as a draftsman?	Salient points are given below.			
9. Should more emphasis be placed on free-hand drawing and sketching?	75	Yes, 44 58.7%	No, 31 41.3%	
10. General remarks.				

The answers received to question eight were so varied and enlightening that a satisfactory tabulation like the one above could not be made. A number commented on the advantages which

* Read at Summer School Conference of Division of Drawing and Descriptive Geometry, S. P. E. E., Madison, Wisconsin, June 19, 1936.

might be derived from practical experience in the drafting room. In view of the fact that many industries require the young engineer to begin his career in the drafting department, students should be advised to avail themselves of work of this kind during vacation periods. However, there was enough similarity in the replies to question eight so that it has been possible to make a grouping, as shown below, of the salient points common in many replies.

1. Drawings lack legibility and proper line weights for the making of clear prints.
2. Improved lettering is essential.
3. Drawings should be properly dimensioned and then checked.
4. More problems of a practical engineering nature should be introduced in the class work.
5. More emphasis should be placed upon the geometry of drawing, including plane, solid and descriptive geometry.
6. The young engineering graduate lacked the ability to recognize the engineering aspect of the problem.
7. He was lacking in knowledge of manufacturing procedure.
8. He showed a lack of speed in both sizing up the job and in the execution of the drawings.
9. There is an evident lack of ability to do independent work.
10. Lack of aptitude and ability due to the recent underevaluation of the importance of drawing in engineering.
11. Drafting should be continued throughout the technical course with an accompanying improvement in technique and application.

All of the general remarks were both valuable and instructive. It is regretted that it was not feasible to publish all of them. It is believed, however, that the inclusion of several excerpts (printed below) taken from these will be of interest.

Remarks

We cannot expect too much of the young graduate, of course, but within a short time industry will discover whether he is suitable for the job he has undertaken or not. Good draftsmen are few and far between. Should he possess this talent, his progress will be accelerated in the engineering department.

With reference to items 6 and 7, I would endorse 250 to 300 hours per year for two years. In general, 250 hours is ample to cover the actual making of a drawing or tracing which is suitable for satisfactory reproduction; however, this is a very small portion of the function of a drawing. The second year would be devoted to the necessary information on a drawing, and how it should be presented. I cannot emphasize too strongly the necessity for thorough training on the latter point.

The particular deficiencies of those having drafting training, whether it be at college or schools for drafting alone, are that the students do not appreciate sufficiently that the day of artistic drawing is passed. What we require to-day is legibility and a full appreciation that the drawing is to be used by a mechanic who has no previous knowledge of what is required, nor does he have any other information. The vagueness of the drawing includes the draftsman's unfamiliarity with the tooling facilities involving economies with the equipment available; the proper views and sections for rapid and correct interpretation, and most importantly the location and method of giving dimensions which also is governed by the planned machining process. *My opinion of a good drawing is not one that can be understood, but preferably one that cannot be misunderstood.*

I wish to comment that in general the engineering graduate does not look favorably on entering industry to work on the drawing board. I think more emphasis should be used in the training to make him appreciate that the drawing board is the place where the best and most efficient designing can be carried on. The trend in industry is such that drawings play a very important part in the planning of economical manufacture in all its phases. Obviously the design itself and the dimensions on the drawings must be sufficient so that they will fit in to the best advantage with the manufacturing conditions, tools available and desirable at the place where the apparatus is to be manufactured.

The absence of practical working drawings selected from the industries to use for examples in school courses is a handicap. The graduate seldom has any idea of the "break-down" of assemblies into component parts and the relation of an assembly to sub-assemblies or details. There is also a great lack of knowledge of practical considerations such as machining tolerances.

We have learned from a lot of experience, that good drafting is important, but the average man who comes out of our engineering schools has two very serious faults with his drawing.

1. He does not seem to appreciate that drawings may be classified into:

a. An engineering drawing which is nothing if it is not correct.

b. An artist's conception, which does not take careful dimensioning into account.

2. He does not seem to realize that an engineering drawing is of no value unless it is so dimensioned that the Factory Personnel, down to the workmen, can interpret it quickly for use so that factory time is saved.

We have not as yet employed a single man direct from our colleges who has had these basic truths pounded into him so thoroughly that he could do a job without a lot of instruction. We have a veteran crew of engineers and draftsmen here now. However, we only recently let several of these go because they seemingly could not be taught to make drawings which could be quickly interpreted by

the Factory Personnel so that the part could be made correctly and at low cost.

Good draftsmen are hard to get. Men with initiative and creative ability are always in demand.

You will note from my answers that you have touched on the one thing that I have contended for years. "Our universities have overlooked the importance of drafting in their engineering courses, particularly with regards to ink work."

The teaching of mechanical drawing in the engineering colleges and universities in the United States has been sadly neglected in the last twenty-five years. Previous to that a graduate from M. I. T. or any other high class technical school was usually a fairly good draftsman and took considerable pride in being such.

In recent years it has been quite different. Graduates from colleges know very little about working up designs and making neat mechanical drawings. There are a few exceptions but they are usually found to be men who have broken up their college career and gone to work a few years in drafting offices and then gone back to college again.

The writer has been in charge of drafting rooms for more than twenty years and has hired and been in contact with many men. We have, therefore, been rather frank in our comments and can assure you that if the art of making designs and drawings can be improved upon in our schools it certainly would be fine, not only for the students themselves but for the engineering profession as a whole.

Lack of appreciation of the importance of drafting with a feeling that it is irksome detail work beneath the dignity of his superior engineering knowledge.

More stress should be placed on the practicable application of his theoretical knowledge to design and to costs involved. With the tendency to eliminate ink drawings, which practice is becoming more general each year, it necessitates the making of the original drawing in a more finished state than was the case when tracers were employed to transfer the original in ink to tracing cloth.

The engineering industry is faced with a serious shortage of draftsmen. During the depression years, opportunities to train new men were very few; employers insisted that applicants for employment be trained men with several years of experience, consequently no new material was introduced.

There has been an idea prevalent among many of our young engineers that if they made a first class drawing they were likely to be sidetracked and never get more advanced work. To me, a clean cut drawing indicates that the man should be considered for advancement ahead of a careless worker.

College drawing work is too often supervised by seniors or other parties who have no practical experience to guide students. A good draftsman always gets preference over a poor draftsman and 95 per cent of college graduates in engineering courses show lack of drawing experience.

I believe that the adoption of definite problems which occurr in engineering work will make class room drawing exercises more effective.

We have found that young engineers—starting in the drafting room—need a good training period to make them useful to the organization. All young engineers, starting with us, must start in the drafting room.

Making an engineering drawing invariably involves some element of engineering design. Graduates rarely have the practical knowledge required for design and it can only be acquired by experience. Students should be thoroughly grounded in the geometry of drawing, practice in the use of drafting instruments and taught simple legible lettering. To this end they should have drafting practice throughout their course. In this way they may gain the art of representation and conveying their design ideas to others who may have to execute these ideas in the field.

The thing the young engineer most often lacks is a clear conception of what engineering is all about, and just what it is he should do to function most usefully in that field. This theory, applied to the matter of drafting, would mean that it is highly important for the young engineer to have a thorough understanding of—

First, the use to which the drawing will be put by the person to whom it is sent;

Second, what were the fundamental things the designer wished to convey by means of the drawing?

I have observed that the average young engineer who is graduated from college, shuns drafting probably because he is of the opinion he is fitted to do much greater things. The truth of it is, however, he should continue his drafting at least between other duties so that he becomes expert, if at all possible. It has been noted many times that the engineer who is a qualified draftsman makes better progress than those who are likely to shirk the drafting duties while they are beginning their engineering career.

I would suggest that in teaching engineering in universities much stress be placed upon the necessity for drafting to be done at intervals during the full college course.

Visits to installations would be most valuable to obtain first hand knowledge of the appearance and functions of the machinery for which he may be required to do the drafting.

I have in the past hired many young men who were graduates of good engineering schools and who could not make a good ordinary drawing, and they have told me that one of the last things they were told before leaving college was not to let anyone make draftsmen out of them, etc., although the greater part of important engineering is carried out by engineers, designers, etc., in the office.

Within the limits of this survey it can be concluded:

1. That 74 per cent of our young engineering graduates cannot make a clean-cut drawing.
2. That 75 per cent cannot make a fairly complicated drawing.
3. That a one-year course in college drawing is not enough.

4. That it is desirable to extend drawing instruction over a two-year or longer period.

Despite the tendency in recent years to reduce the time allotted to drawing instruction, it is believed that progress lies in the opposite direction. Not only must we make every effort to retain the present courses, but also we should supplement them with additional courses necessary to give our students a good foundation in the graphic language. When we realize that 80 per cent of our entering freshmen (Minnesota experience during recent years) have had little or no preparation in drawing, can we hope to meet the demands of industry in the brief instructional periods included in present day engineering curricula?

IS INVENTION STIMULATED BY ELECTRICAL ENGINEERING TRAINING?

By A. G. CONRAD

Assistant Professor of Electrical Engineering, Yale University

At no time in the history of our country have the accomplishments of engineering received more recognition and more approval than during the last few decades. This approval has been extended to the engineer and the steady increase in enrollment in our engineering schools is directly indicative of this regard. This increase is particularly noticeable in our Western and Mid-western colleges.

But the advantages of engineering education are not so universally appreciated. We, who are connected with the older educational institutions on the Atlantic seaboard, often encounter educators who, while admitting the triumphs of engineering, are inclined to doubt that a similar appreciation should be extended to the engineer and to engineering education. Specifically their attitude is that engineering training, as given in our engineering schools, is not a valid education. While this stricture may not be justified, the fact remains that criticism cannot be ignored.

Why should engineering education receive such esteem from some people while at the same time others question its real value? The reason, I believe, is the point of view. The first group judges the engineering profession by the accomplishments of engineering inventors. The second group, many of whom are educators, judges the engineering profession by the engineers with whom they have come in contact.

There is a vast difference between, on the one hand, the engineer who has contributed directly to the improvement of our standards of living, and, on the other hand the average engineer of to-day. It is the work of the inventor of forty or fifty years ago that holds interest. It is the work of a few men such as Westinghouse, Edison and Bell who, possessed with originality, foresight, inventive genius and ambition, have sowed the seed in the fields that we are now reaping. Certainly it is not the engineering skill of the recent graduate that is so highly attractive to the engineering freshman. There is a tremendous amount of engineering being done these days, but a large portion of it is not fundamental and would not have been classified as engineering thirty years ago.

I am not in a position to speak on the trends in all branches of engineering, but I believe that there has been considerable change

in the art of electrical engineering and possibly the whole engineering profession. One of the facts of engineering now well recognized is emphasized by Lewis Mumford in his book "Technics and Civilization," and also by C. C. Furnas in "The Next Hundred Years." Both authors point out that the frequency of the occurrence of *important* inventions has diminished during the last sixty years. The number of applications for patents increases gradually, but the number of important inventions occurring at the present time are becoming fewer and fewer. Most people believe to the contrary; but if they will refer to the American Encyclopedia they will find there a list of important inventions, their dates and the inventors. The data in this list are shown graphically in Fig. 1; the number of important inventions occurring in the world per decade are there plotted against time.

The portion of the curve (Fig. 1) between 1880 and 1930 indi-

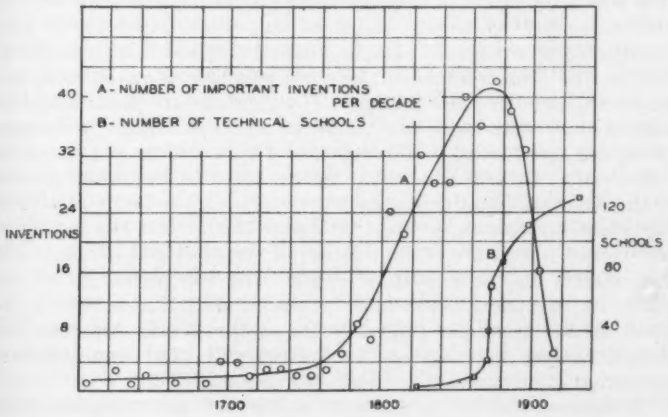

FIG. 1

cates a pronounced decrease in the frequency of occurrence of important inventions during this period. A factor not to be overlooked here is that occasionally inventions are not given recognition until years after their occurrence. This was true several hundred years ago. But times have changed and the interval between invention and production has been reduced tremendously. It is doubtful if there are many important inventions of thirty years ago that are not recognized to-day. Many reasons could be advanced for the fact that this curve drops steadily over this period, but we, as engineering educators, are primarily interested in how engineering education has affected this trend of inventions. On the coördinates

of Fig. 1 is another curve showing the number of institutions in the United States that offer technical education. This curve is not significant in itself but it serves to give us some idea of the number of engineering graduates during this period. A curve showing the number of mature engineering graduates would not only be steeper than that of the institutions, but it would be shifted to the right by about fifteen years.

Perhaps such a curve of engineering graduates bears no relation to this curve of inventions. It may be just a coincidence that the slope of one curve is positive and the slope of the other negative. Nevertheless this is certain, there is no indication that an expansion in engineering education or the increase in the number of engineers has brought about a greater number of important inventions.

Before drawing the apparent conclusions that engineering education discourages invention, it might be well to question the data from which the curve of inventions was derived; to ask who is in a position to say which are the most important inventions? Obviously only an average of many opinions could decide such a matter. Thus in the World Almanac there are two lists of inventions, one American, and the other foreign. If these lists are plotted against time we find that both the American and the foreign inventions follow the same trend as the curve of Fig. 1. This fact seems to indicate that there is something besides the vast industrial growth on the American continent that has resulted in the large number of important inventions between 1860 and 1890. But the matter of importance to us here is the relation of the electrical inventions in this country to the growth of engineering education. If all the important electrical inventions of the United States, which are listed in the American Encyclopedia or the World Almanac, are plotted against time, we are confronted with the same evidence: the period of electrical inventions was around 1880.

It appears that the present-day deluge of engineering education has not stimulated invention, or that if it has stimulated invention, there are other factors that have made their appearance since 1880 that offset any increase resulting from engineering education. I do not see any large factors of this nature. It has been said that there are not as many things to be invented as there were in the past. I see no reason to subscribe to this excuse. Engineering educators certainly cannot honestly believe that the fields of research have been harvested. If they did, they might as well write up what has been done, place it on the library shelves and close the doors of all research laboratories. Not many of us would approve of that step.

Here are the facts: Engineering education has increased; invention has decreased. There may be no relation between these two trends, but it is difficult to escape the impression that they are to

some extent related, and that at least part of this reduction in the number of important inventions can be attributed directly to certain educational procedures found in many of our engineering schools. Under present systems many undergraduate students of electrical engineering, who possess all the prerequisites necessary for the development of the inventive type of engineer, are shunted into undergraduate and graduate courses that are designed to equip them with methods of rigid mathematical analysis rather than to develop their natural talents. Oftentimes these courses take from five to eight years of the most productive part of a student's life. When he has finished them he possesses a keen analytical ability, and a habit of depending upon his mathematical tools to solve all types of problems. He can solve difficult problems and has acquired a habit of presenting the solutions in a most pleasing manner to the instructor or superior who gave the problems to him to solve. But does he ever go out and find these problems himself? Perhaps once in a while, but not often. He is kept too busy with his engineering courses to think of other things. By the end of five or six years he has become a human comptometer. But what has been done in the meantime in the way of developing his natural talents, his originality? Not much to be sure, and all the time he is growing older. He is approaching middle age and as yet he has not proved to the world that he can support himself. The best thing that he can do now is to find a job where he can earn a respectable living with the educational equipment he has. So he goes into industry and there astounds his associates with his ability to get quantitative answers to the difficult problems that others provide. But it is the other people who still provide the problems. He solves them. That has been his training. By this time any inquisitive attitude that he may have possessed when a freshman has been well quenched; his originality has atrophied.

This is a pessimistic way of looking at our electrical engineering courses. Nevertheless it approximates just what is happening to many of our engineering students to-day. We cannot condemn these courses or the men who have so carefully planned and presented them. They have placed the emphasis on mathematical analysis rather than on inventive training. This seems to be what industry wants; it is this type of training that proves most suitable in preparing the student for an industrial position. It is the type of training that is offered in many of the post-graduate courses conducted by industry. An outstanding example of this last type of training is the advanced course of the General Electric Company which has been so well described by A. R. Stevenson and Alan Howard in *Electrical Engineering*, March, 1935. Probably nowhere in the country can one find a more suitable course for the preparation

of young engineers along mathematical and analytical lines. Probably nowhere in the country can one find more carefully selected groups of college graduates than those chosen for this advanced course. Over a period of ten years, company representatives have interviewed some 70,000 graduating seniors. Approximately 5,000 of these students, on the basis of their excellence, were selected by the company. From this group of 5,000 only 309 have been selected for the advanced course and 70 have completed its full three years. These 70, selected from 70,000, represent one of the most highly trained groups of young electrical engineers in the country. Highly trained for the jobs that the company has open, such as designing and solving problems; and occasionally they advance the theories of machines, many of which have been working satisfactorily for some time.

What can be expected from such a highly trained group? It is not unreasonable to assume that these men possessed some originality along with their other qualifications when they started their engineering courses, and that this originality has been developed by the processes of education. If such is the case it is not unreasonable to assume that these men, who have taken part or all of this course, should produce two original ideas per year. This is not a high figure. Many men of science are producing more. On this basis the 309 men, who have taken the course over a period of ten years, should by now have produced $\frac{309}{2} \times 10 \times 2 = 3{,}090$ original contributions to the art of engineering or of science. In describing the accomplishments of this group, Messrs. Howard and Stevenson state that it has produced, during this period, eighty publications and General Electric Review articles. This represents about one paper per man every twenty years. This is a low average for men of their calibre and schooling. Of course there are undoubtedly many fine ideas produced by this group that have never been put in print, but it is also undoubtedly true that many of the papers produced in this list of eighty do not contain original or inventive contributions. Certainly one conclusion is justified,—the ratio of actual accomplishments to expected accomplishments indicates that the training of this group, both in college and in industry, has not been along the lines that develop originality or inventive genius. It has made mathematical analysts, specialists in solving problems—somebody else's problems.

I do not wish to condemn industry in its educational program, but it naturally stresses the development of industry. The university should stress the development of the individual. Industry is operatively minded rather than creatively minded. Greater emphasis is placed on the manufacturing of old things than upon the

creation of new products. This proportion of emphasis is advantageous for the industry from the standpoint of making money. But the unfortunate thing about such a setup is that our best graduates are steered into post-graduate courses and positions that are not highly conducive to the development of their inventive genius. The student engineer, like the machine in the factory or the manufactured product, has become standardized. This standardization is not limited to industry. A certain amount of it can be found in our colleges and universities, and not all of it is imported with the faculty members who are chosen from industry. Undoubtedly this standardization reduces educational costs and is advantageous from the standpoint of placing the student in an industrial position after his graduation. But can it be sufficiently important that the talented, inventive student must be forced into its mold? Certainly nothing can be so important when it is practiced at the expense of the more important phase of what we educators term "true education"—the development of the individual. For "true education," said Felix Schelling, "makes for inequality, the inequality of individuality, the inequality of success; the glorious inequality of talent, of genius. For inequality, not mediocrity—individual superiority, not standardization is the measure of the progress of the world."

What then is the purpose of an engineering education? If its purpose is to train men to solve problems for industry, and to provide sufficient background so that the college graduate can go into industry and make a respectable living doing work of a secondary nature, then certainly the colleges are making a noble attempt to fulfill their mission. But if the purpose of an education is to develop the individual rather than to remake the man, to develop his talents rather than to standardize his thoughts, then certainly engineering colleges are not doing all that they could for the talented student.

Scientific acquisition of knowledge usually passes through two stages: the first stage, related to inventive thinking, consists of discovering the problem, grasping its ramifications, weighing them with respect to their importance and usefulness, and deciding on and checking their feasibilities; the second stage has for its purpose the exact numerical determination of relations. This is the mathematical stage. In many cases it does not exist. If it does exist, it must follow after the inventive stage of the problem. It is the first stage which, if properly emphasized, leads to the development of invention. The second stage develops the mathematical analyst. It is this secondary stage that has received the greater emphasis in our electrical engineering courses and oftentimes it has crowded out the more important stage. Consequently electrical engineering education has not made inventors.

Electrical engineering courses could be helpful to the inventive student if more emphasis is put on the first stage—the inventive stage. It is not impossible to make inventors any more than it is impossible to develop swimmers. We know that few people will learn to swim if they are kept out of the water. Likewise we cannot expect to develop inventors unless the student is given an opportunity to develop his intellectual curiosity and originality. Necessity is not the mother of invention. Necessity is the mother of substitutes. Invention is the offspring of intellectual curiosity.

It is this intellectual curiosity that should be developed in the student. He must not only be assisted in this development through various educational procedures, but he must be provided with time to develop this talent, and time to apply it. An electrical engineering program incorporating these provisions must, of course, place less emphasis on mathematics, but it will in the end correspond more nearly to a course fulfilling the requirements of an ideal education. It must be remembered that our technological advancement in the future depends upon the inventive genius of our present day engineers, and that improvements in our standards of living are directly dependent upon the creative work of these men. Public regard of the engineers depends upon their original contributions rather than on the efforts they expend doing work of a secondary nature.

In the future, as in the past, the value of an engineering education will be measured by the kind of services that the graduates perform. If the work of the graduates is to be confined to something of a secondary nature, we can expect engineering training to be given a second degree rating in the field of education; but if these graduates are to devote their efforts to the creative side of engineering, their accomplishments will be more evident and of greater value to society, and engineering education will automatically take a position that is second to none.

REPORT OF CONFERENCE ON MECHANICS

At the Conference of the Division of Mechanics, June 24, 1936, at the University of Wisconsin, F. B. Seely, presiding, appointed S. B. Folk as secretary.

The order of presentation of the papers for the two sessions was "How Members Fail Under Load" by Thomas J. Dolan; "Liquid Mechanics vs. Fluid Mechanics" by Glenn Murphy; "Thin-Walled Structures as Applied to Railway Equipment" by R. Eksergian; "The Validity of the Photo-elastic Technique for Determination of Stress" by M. M. Frocht.

Professor Dolan discussed the failure of members by (*a*) elastic deformation and by (*b*) elastic buckling, pointing out that failure is defined at the stress where the member fails to function properly. The significant stress may be far different from that obtained by the ideal stress distribution formulas, i.e., the direct stress or flexure formula. The type of loading may further complicate matters, since the engineer may be totally unfamiliar with corrosion, and high or low temperature phenomena.

Professor Murphy's paper was brief and summarized the present state of teaching hydraulics. His paper follows:

Liquid Mechanics vs. Fluid Mechanics

I have been asked to open up a discussion of the changes which need to be made in the undergraduate courses in hydraulics to bring them in line with recent developments in the field. The title, "Liquid Mechanics vs. Fluid Mechanics," was chosen to emphasize one of the major questions before us to-day—namely, should the old courses in hydraulics or liquid mechanics be traded in on a new course in fluid mechanics?

A brief outline of the general subject will serve to indicate the trends. Until less than ten years ago the subject of hydraulics was essentially what its name indicates—a study of water. Statics, or the determination of forces on submerged areas; kinetics, or the determination of discharge; and dynamics, or the determination of impact energy; with a brief discussion of pumps and turbines thrown in for good measure, made up the subject matter of the course. Assuming satisfactory teaching methods, this material prepared the student to meet the ordinary problems dealing with the transportation and storage of water—civil engineering problems. This material did not provide satisfactory training for the mechanical

and chemical engineer who had to solve problems dealing with the transportation of gases and liquids other than water. Neither were the methods of hydraulics entirely amenable to the modifications necessary to make them suitable for solving other important problems. Out of the researches made primarily by the mechanical and aeronautical engineers came the application and extension of dimensional analysis, and particularly Reynolds' number—material which has been available but unused for many years. Their methods were also applicable to some of the new problems the civil engineer was having to meet—problems such as the flow of oil through pipe lines. Consequently, the use of Reynolds' number has found its way into the undergraduate hydraulics, making what might more nearly be called liquid mechanics. That is where we find the subject to-day, dealing primarily with water, but including the flow of liquids through pipe lines.

We find it taught under a wide variety of conditions, with credit ranging from two to five quarter hours, or the equivalent. We find it taught as recitation or lecture, and with or without demonstration or laboratory. It may be taught in any one of several different departments. An analysis of the courses in twenty of the larger engineering colleges in the country shows hydraulics being taught in the civil engineering department of thirteen, in the mechanics department of five, and in separate hydraulics departments of two. In five of the twenty, similar courses are given in mechanical or chemical engineering as well. This may explain in part why the usual course is set up to deal with civil engineering problems rather than with problems of such a nature that they would be of benefit to the engineer regardless of the field with which he happened to become associated after graduation.

Do these data indicate that one basic course should be given to the civil engineering students, and another basic course given to the mechanical and chemical engineers? I emphatically think not, for several reasons, two of which bear directly upon the question of course content—the others are related more directly to the problem of departmental management from the viewpoint of a department of mechanics.

In the first place, our duty as teachers of hydraulics or fluid mechanics is not to teach a number of special cases directly related to some special field of activity. There has been too much of that in the past, confusing the student with the apparent multiplicity of special unrelated problems. It is our duty to teach the fundamentals and to teach them so well that the student will be able to recognize them through the camouflage of irrelevant data in any practical problem. Those things which are fundamental to a problem in the flow of a fluid are the same whether seen through the

eyes of a civil, mechanical, or chemical engineer. Those subdivisions are arbitrary—the fundamentals are fixed. If we would teach these fundamentals as they should be taught, the major departments would have more time on the special applications in the subsequent courses in their own professional fields.

Another reason that the same fundamentals (rather than special professional problems) of fluid mechanics should be taught to all engineering students is that the practicing engineer is not limited to one special type of problem, but may be called upon to deal with problems in any phase of fluid mechanics. The civil engineer of twenty years ago may have been concerned primarily with water, but the one of to-day must be prepared to deal with pipe lines for the flow of oil, gas, cement, sand, mud, and concrete as well. Not only that, there are the many problems of river and harbor control, soil erosion, and a score of others which demand from the engineer a knowledge of fundamentals. There is no use there for a handbook of coefficients and charts—the engineer must know enough of the basic principles governing the actions of the fluids to work out solutions of his own.

In the field of mechanical engineering, problems of lubrication, metering of gas, pulsating flow, air conditioning, and streamlining are being solved by men who understand the basic principles of fluid mechanics. And so it is with the other branches of engineering —chemical and aeronautical in particular.

We have seen some of the needs of the engineer of to-day—but what of the future? We are not training the engineers of 1936 in our undergraduate courses of to-day, we are teaching the engineers of 1970. What will be their problems? If we only look at to-day's needs, and fit our students for them—we are simply saying that there will be no progress in engineering. We must consider the future as well as the past and present. How can we project the curve of progress into the future? Extrapolation is a dangerous procedure unless we know the basic equation of the curve. The past will give us some indication, but of more importance is the slope of the curve at the present. The first derivative of the curve of progress with respect to time is research—where research is a positive quantity, progress is upward.

Research in fluid mechanics is being carried on in many fields—research in basic ideas, research to determine empirical coefficients, and all of the intermediate stages. Significant is the fact that most of the researches deal with one of two subjects not covered in the great majority of undergraduate courses in hydraulics—the flow of fluids and the treatment of dimensional analysis.

Inclusion of these two items in the undergraduate course would not involve very much change in the mechanical details of teaching.

The basic equation including a term to include compressibility gives the basis for the study of the flow of fluids, and yet is readily convertible into the familiar Bernoulli equation—the basis of the present hydrokinetics. The approach to dimensional analysis need not be made mysterious, and yet it will give the student an idea of the why of Reynolds' number—and help him to realize that there are other criteria of similitude which are just as important, and help to prevent him from falling into the common pitfall of believing that all hydraulic phenomena are dependent upon Reynolds' number alone.

In most courses in hydraulics these changes could be effected without demanding more time, and without discarding anything vitally important. The derivation of the equation of flow of a fluid takes no more time than the derivation of Bernoulli's equation, and yet it is an infinitely more powerful tool. Dimensional analysis should be administered earlier in the term, and followed by continual reference to its use and value as each new situation is studied.

Summarizing, I would say that undergraduate courses in hydraulics need to be broadened to include basic work with the fundamentals of fluid mechanics which the student will need as an engineer regardless of what particular field he enters upon graduation.

In the discussion which followed, Professor Reynolds pointed out that the paper excludes the mathematical treatment and dimensional analysis of value to the undergraduate. Professor Lilly (Swarthmore) said that engineering failures are not due to mistakes, but to overlooking something fundamental. The undergraduate must appreciate that the usual formula for water will not suffice for everything. Professor Bailey (Rutgers) believes this should be taught in a service department. The previous effort tended to show what hydraulics is—rather than why it is—and to develop empirical formulas. Now new units are needed, definite and well-named. A close connection should be maintained with thermodynamics. Professor Lansford (Illinois) agreed with Reynolds. The transmission of oil and gas, the application of fluid mechanics to the airplane and heat transfer require comprehensive mathematics beyond the ability of a junior engineering student. Viscosity should be fully understood. We are inclined to spend too much time on weirs and orifices and not enough in dynamic similarity. Professor Adams (Colorado School of Mines) remarked that his department teaching all the mechanics, hydraulics, and thermodynamics was able to save some time by introducing the general Bernoulli equation early. In answer to Dean Lassalle's (Louisiana) question about the number of institutions giving separate courses in fluid mechanics Professor Switzer (Cornell) estimated fifteen to twenty.

MEETING OF APPLIED MECHANICS AND HYDRAULICS DIVISION, A. S. M. E.

The fifth national Applied Mechanics meeting, together with a meeting of the Hydraulics Division, A. S. M. E., will be held at Cornell University, June 25 and 26. Preliminary plans include four sessions of the Applied Mechanics Division. Each session will be devoted to one general topic. The session on Elasticity is under the leadership of S. Timoshenko; Fluid Mechanics under the leadership of H. L. Dryden; Plasticity under the leadership of A. Nadia; and Vibration under the leadership of F. M. Lewis. C. R. Soderberg is Chairman of the Division. The Hydraulic Division sessions will be devoted to Cavitation under the direction of S. Logan Kerr, Chairman of the Division, and C. F. Merriam, sponsor of the Cavitation Committee.

An invitation to attend is issued to members of the S. P. E. E. who might be able to stop over in Ithaca on their way to the Cambridge meeting of that Society scheduled to begin on June 28.

SECTIONS AND BRANCHES

Illinois-Indiana Section.—A meeting of the Illinois-Indiana Section was held at the University of Illinois, on April 5, with President R. P. Hoelscher in the chair. Dean M. L. Enger of the University of Illinois gave the address of welcome. Dr. David J. Davis, Dean of the College of Medicine, University of Illinois, spoke on: "What the Recognition Policy of the A. M. A. has done for Medical Schools." D. B. Steinman was unable to attend the session, and H. E. Babbitt, Professor of Sanitary Engineering, University of Illinois, delivered an address on the same topic assigned to Dr. Steinman, "What the Accrediting of Engineering Colleges may mean to the Engineering Profession." A. A. Potter, Dean of the College of Engineering and Director of the Engineering Experiment Station of Purdue University, next addressed the section on "Policies of the Accrediting Committee of the E. C. P. D.

New Business

Article V of the Constitution was amended by the addition of the sentence "The immediate past-president shall be a member (ex-officio) of the Executive Committee." Article VII of the Constitution was amended as follows: Section II. The president of the Section shall appoint a nominating committee whose duty it shall be to select one candidate for each office and the members of the Executive Committee as specified in ArticleV. The Committee shall report at the business session of the annual meeting.

It was moved and seconded that the President of the Section shall be the representative of the Section on the E. C. P. D. organization of the Chicago area.

The nominating committee, composed of B. H. Petty, Purdue, Chairman, J. O. Draffin, Illinois, J. S. Thompson, Armour, L. J. Haga, Lewis, Carl Wischmeyer, Rose, W. G. Smith, Northwestern, and W. L. Shilts, Notre Dame, presented the following slate and all nominees were elected:

President—O. L. Stock, Rose Poly.
Vice-President—J. G. Bennett, Lewis.
Secretary—M. B. Gammett, Northwestern.

Executive Committee

R. E. Rich, Notre Dame Univ.
H. A. Moench, Rose Polytechnic
S. E. Winston, Armour Institute
W. M. Lansford, Illinois Univ.
H. L. Creek, Purdue Univ.

The invitation of Rose Polytechnic was accepted, since the last meeting was held in Chicago. D. C. Jackson then extended an invitation for the annual meeting of the academic year 1938–39 to be held at Lewis Institute. Following the luncheon, conferences were held as follows. The attendance at all conferences was 243.

Chemical Engineering—D. B. Keyes, Illinois, Chairman.
Limitations of Enrollment at Purdue—J. L. Bray, Purdue.
Limitations of Enrollment at Illinois—L. Byman, Illinois.
A Comparison of Scholastic Achievement Between Selected and Non-selected Groups of Students—J. A. Schaad, Armour.
Teaching German to Chemical Engineering Students—John T. Fotos, Purdue.
Engineering Materials for Sophomores from a Chemical Engineering Point of View—A. T. Child, Rose.
Teaching Differential Equations to Chemical Engineering Students—E. W. Comings, Ilinois.

Civil Engineering—R. B. Wiley, Purdue, Chairman.
Teaching Surveying to All Engineers—G. E. Lommel, Purdue.
Soil Mechanics Laboratory for Undergraduates—E. E. Bauer, Illinois, H. Ensz, Armour.
Electives and a Balanced Curriculum—M. W. Todd, Purdue, C. C. Wiley, Illinois.
Problems of Teaching Water Purification—H. E. Babbitt, Illinois, H. A. Vagtborg, Armour.

Electrical Engineering—C. C. Knipmeyer, Rose, Chairman.
Tensor Analysis and Diadics—W. J. Warren and G. H. Fett, Illinois.
Teaching of E. E. to Non-electrical Engineering Students—G. C. Blalock, Purdue.
Laboratory Methods in Practice—F. A. Rogers, Lewis.

English—R. B. Parks, Lewis, Chairman.
English and the Engineers Professional Status—H. L. Creek, Purdue.
Discussion—B. L. Jefferson, Illinois.
An Engineer's Opinion as to What an English Teacher Should Teach—H. Holmquist, G. E.

A Speech Teacher's Opinion as to What His Job Is—A. D. Huston, Illinois.
Discussion—J. L. Bloxsome, Rose.
Should the Engineering English Teacher be an Engineer?:
(a) An English Teacher's Opinion—W. F. Bryan, Northwestern.
(b) An Engineering Teacher's Opinion—E. H. Freeman, Armour.
Discussion.

Engineering Drawing—W. H. Seegrist, Armour, Chairman.
Exhibits of Drawings from Various Schools—A. Jorgensen, Illinois.
Grades in Mechanical Drawing—O. L. Stock, Rose.
Effective Methods of Teaching Descriptive Geometry—W. G. Smith, Northwestern.
What Does Industry Expect of the Engineering Graduate in the Drafting Room?—C. A. Dopp, Crane Company, Chicago.
Engineering Letters—
Sound Film—Justus Rising, Purdue.
A conducted tour of the Engineering Drawing Department.

Mathematics—H. W. Bailey, Illinois, Chairman.
How Shall We Effect Better Coördination Between Mathematics and Technical Engineering Courses?:
(a) An Engineers Viewpoint—J. J. Doland, Illinois.
(b) A Mathematician's Viewpoint—W. C. Krathwohl, Armour.

Mechanical Engineering—Carl Wischmeyer, Rose, Chairman.
Recent Developments in Steam Power Plants—H. L. Solberg, Purdue.
Photo-elasticity as a Tool for Engineers—H. A. McAninch, Link Belt Co., Indianapolis.
Cavitation—C. P. Kittredge, Illinois.

Shop Laboratories—J. D. Hoffman, Purdue, Chairman.
What Should Be Minimized, Emphasized or Eliminated in Shop Courses, Credits, Time Allowed, etc.—W. A. Pearl, Armour.
Discussion—F. H. Thomas, Illinois.
Character of Courses and Means of Presentation—R. W. Lindley, Purdue.
Discussion—E. W. McCullough, Consulting Engineer, Indianapolis.
Advanced Engineering Features, Production Management and Personnel Methods—C. H. Casberg, Illinois.
Discussion—W. K. Creson, Ross Gear & Tool Co., Lafayette, Ind.

Economics—A. S. Hansen, Armour, Chairman.
Panel Discussion of Economics with Following Topics and Leaders:
Business Law—D. T. Canfield, Purdue.
Accounting—G. H. Shepard, Purdue.
Business Organization—A. G. Anderson, Illinois.
Technology—Fred L. Serviss, Purdue.
Finance and Banking—Paul M. Van Arsdell, Illinois.
Marketing—Judson H. Lee, Armour.
Transportation—E. E. King, Illinois.
Social Control of Business—D. B. Prentice, Rose.

Physics—B. H. Howlett, Rose Polytechnic, Chairman.
What Should the Work in Physics Contribute to the Training of the Student of Engineering?
An Engineer's Viewpoint—Mr. Angus, Esterline-Angus Co., Indianapolis.
An Academic Viewpoint—W. C. Bauer, Northwestern.
Some Special Features of Teaching Technique—R. B. Abbott, Purdue.
Student Opinion of Laboratory Experiments—C. V. Oberbeck, Northwestern.

Mechanics—F. B. Seely, Illinois, Chairman.
Methods Used at Different Institutions for Presenting the Work in Mechanics with Emphasis on Recent Changes Introduced —S. D. Chambers, Purdue, C. O. Harris, Armour.

Inspection of concrete, fatigue of metals, photo-elasticity, vibration, hydraulics and student Materials Testing Laboratories at the University of Illinois with demonstration of test in 3,000,000 lb. testing machine at 3:00 P.M.

S. M. SPEARS,
Secretary.

At a meeting of the **Lafayette College Branch** of the S. P. E. E. on April 29, the following officers were elected for next year:

Chairman—Professor E. M. Fernald
Vice-Chairman—Professor F. W. Smith
Secretary-Treasurer—Mr. Paul P. Rice

The first business meeting of the **Michigan Section** of the Society for the Promotion of Engineering Education was called at 3:45 P.M. at the Grand Rapids Junior College, Grand Rapids, Michigan, on April 24, 1937. 119 members and guests were registered. H. B. Dirks, Michigan State College, presided as temporary chairman. Chairman Dirks announced the formation of the Michi-

gan Section of the Society for the Promotion of Engineering Education. It was voted to appoint a nominating committee and direct the committee to submit nominations for chairman, vice-chairman and secretary. A Nominating Committee was appointed as follows:

C. A. Brown, General Motors Institute of Technology
A. R. Carr, Wayne University
L. N. Field, Michigan State College
A. H. Lovell, University of Michigan
R. W. Tapy, University of Detroit
R. A. White, Grand Rapids Junior College
C. C. Winn, Detroit Institute of Technology

Upon recommendation of the Nominating Committee, the following officers were elected:

R. H. Schoonover, Wayne University, Chairman
R. W. Tapy, University of Detroit, Vice-Chairman
E. L. Eriksen, University of Michigan, Secretary

The newly elected officers were empowered to confer with the University of Toledo with reference to a joint Michigan-Ohio Section meeting in the Spring of 1938, which the University of Toledo had proposed.

The following program was carried out.

P.M.

2:00 Address of Welcome—R. A. White, Grand Rapids Junior College.
"Art in Engineering"—J. A. Persons, Michigan State College.
Business Meeting.
"Labor Laws—Michigan and Federal"—J. C. Davis, Michigan State College.

5:00 Friendship and Acquaintance Session, and Trip Through College.

6:30 Dinner Meeting—Women's City Club. Presiding—R. A. White.
Greetings—Arthur Andrews, President, Grand Rapids Junior College.
Response—A. H. Lovell, University of Michigan.
Address—"A Needed Perspective"—L. W. Wallace, Director, Planning and Research Dept., Ass'n of American Railroads.

C. J. FREUND,
Temporary Secretary.

On December 18, the **Newark College of Engineering Branch** held a meeting to discuss the second of Mr. Baker's papers. The paper dealt with "The Problem Method in an Engineering School." It was soon realized, however, that this subject had enough value to warrant extending the discussion over another meeting. Consequently on February 19, Mr. Baker presented another paper dealing with the problem method as applied to Laboratory courses.

At the first meeting it developed that in some courses, notably Chemistry, the solution of certain academic and routine problems had to be mastered which at the moment had no particular significance. However, the ability to solve these problems would be extremely important later on and would be useful in solving problems which then would have significance. These problems would show a relatively low value when compared with the proposed outline suggested in the paper. Some time was spent in trying to differentiate between a problem, an illustrated problem, and an example. Several typical problems dealing with various subjects were presented and the relative rating discussed. One of the problems was the one which appears at the end of Mr. Baker's paper concerning the water line and its relative position when a vessel goes from salt water into fresh water.

As a result of the discussion on the paper dealing with laboratory problems it seemed to be the consensus of opinion that in the ideal laboratory the student would be required to discover for himself and entirely by his own efforts certain basic principles. It was realized, however, that this scheme would not be practical since most laboratories do not possess sufficient equipment and secondly too few of the principles would be discovered and developed in the necessarily limited time.

Almost everyone felt that in the laboratories where no previous study was required and where the student sets up the apparatus, takes readings according to directions, laboratory work had but little value. The discussion brought out the fact that practically every Laboratory course at the College of Engineering requires certain preparatory work either of a descriptive nature or the solution of certain problems so that the student is at least acquainted with the general nature and principles of the experiment he is scheduled to conduct.

On March 19, Mr. Baker will lead the discussion on the third paper of his series which deals with "The Question of Classroom Discipline."

Respectfully submitted,

PAUL E. SCHWEIZER,
Secretary.

The new officers of the **Ohio Section** for 1937–38 are:
Chairman—D. M. Palmer, University of Toledo.
Vice-Chairmen—M. E. Haas, University of Dayton; A. C. Ladner, Denison University.
Secretary—S. A. Harbarger, Ohio State University.

The **Pacific Northwest Section** held its fifth annual meeting May 13 at Butte, and May 14–15 at Bozeman, Mont. "Recent Trends in Engineering Education" was the theme of the meeting. The following program was presented:

Thursday, May 13

An informal dinner was held with Francis A. Thomson, President, Montana School of Mines, as the speaker.

Friday, May 14

Forenoon: Inspection tour of air conditioning systems and underground workings in the Butte mines.
Afternoon: Scenic Motor Trip to Bozeman, Montana.
Evening: Informal Dinner, Hotel Baxter, President Thomson, presiding.
Address: Technical and Social Efficiency, President Alfred Atkinson, Montana State College.
Investigation and Administration of Student Loans, William Schroeder, University of Idaho.
Discussions:
E. A. Lowe, University of Washington.
Staff Member, Washington State College.
Business Session: L. D. Conkling, Chairman, Pacific Northwest Section, S. P. E. E.

Saturday, May 15

Forenoon: Tour of Montana State College Campus.
Afternoon: Technical Session, W. M. Cobleigh, Montana State College, presiding.
The Place of the Professional Society and Student Branch on the Campus, Eric Therkelson, Montana State College.
Discussions:
J. C. Othus, Oregon State College.
Staff Member, Washington State College.
The Need for Graduate Work in the Northwest, B. T. McMinn, University of Washington.

Discussions:

L. C. Cady, University of Idaho.

F. O. McMillan, Oregon State College.

A Course in Geological Engineering, E. S. Perry, Montana School of Mines.

Discussion: Member, Montana Society of Engineers.

Evening: 6:30 P.M., Informal Banquet, Hotel Baxter, L. D. Conkling, Montana State College, presiding.

Advanced Report on Fort Peck Dam, Lt. Colonel T. B. Larkin, District Engineer, Corps of Engineers.

Message from President Hammond, S. P. E. E. Presented by W. M. Cobleigh.

The third annual meeting of the **Southeastern Section** of the Society was held at the University of Florida on April 2 and 3, Dean S. B. Earle, Clemson College, Chairman.

The first session consisted of a symposium on the subject of "Testing and Orientation of Engineering Students in the Southeastern Colleges."

Formal discussions on this subject were presented by Dean S. B. Earle, Clemson College, Dean W. S. Rodman, University of Virginia, Dean J. M. Robert, Tulane University, Dean L. J. Lassalle, Louisiana State University, Dean W. A. Little, General College, University of Florida, R. L. Sweigert, Georgia School of Technology. Additional discussions were presented from the floor.

An informal dinner opened the evening session, with Dean B. R. Van Leer, University of Florida, as toastmaster. Dr. John J. Tigert, President, University of Florida, addressed the guests on "Present Trends in Higher Education."

The evening session was adjourned at 8 P.M. to permit attendance at the annual Engineers' Fair, which was the exhibit of laboratory equipment by students in the College of Engineering. The Fair is presented each year for the benefit of the general public.

Dean W. S. Rodman, Vice Chairman of the Section, presided and called the third session to order at 9 A.M., April 3.

Professor S. P. Sashoff, University of Florida, presented his paper entitled, "Correlation of Fundamentals." The interest in this subject which was aroused by Professor Sashoff's presentation will be evident when it is noted that more than 50 per cent of those in attendance took part in the discussion.

Dr. R. C. Ernst, University of Louisville, was elected to represent the Southeastern Section on the Executive Committee of the Chemical Engineering Division.

The Nominating Committee, consisting of Deans B. R. Van Leer, L. J. Lassalle and D. P. Savant, presented the following nominations for officers of the Section for 1937–38:

Chairman—Dean W. S. Rodman, University of Virginia.

Vice Chairman—Dean J. M. Robert, Tulane University.

Secretary—Professor Chas. R. Hixon, Alabama Polytechnic Institute.

The nominations of the Committee were unanimously approved.

A motion to hold the 1938 annual meeting of the Section at Clemson College was unanimously carried.

The subjects, "The Selection, Development and Recognition of Engineering Teachers," "Efforts at Correlation of Subjects in Southeastern Colleges and Efforts to Restrict the Curricula to Fundamentals," will be considered at the next annual meeting.

The Executive Committee was instructed to arrange for a luncheon meeting of the Section to be held during the annual meeting in June.

Dean Lassalle suggested that the letter usually sent out by the secretary of the Section in the fall be addressed to the presidents of the various institutions rather than to the deans.

A motion instructing the chairman to thank the University of Florida for the courtesies shown during the meeting was unanimously carried.

NEWTON C. EBAUGH,
Secretary.

Tufts College Branch.—A meeting of this Branch was held in the Lounge of the Cousens Gymnasium on the evening of March 15, 1937, to discuss the subject "Honors Courses in American Engineering Schools." Professor Frederic N. Weaver gave a history of the movement, told of the development of the idea at Oxford and Cambridge Universities, and outlined the procedure at the Massachusetts Institute of Technology and other American engineering schools. Dean Harry P. Burden described in detail the working of the plan at Swarthmore College, and Professor Edgar MacNaughton and Professor Frederick H. Crabtree discussed the advantages and disadvantages of the plan from the point of view of the small college.

The general discussion was opened by Dean Frank G. Wren, of the School of Liberal Arts, who expressed himself as heartily in favor of the plan as a method of education, and said that some departments of Tufts College were already working in this direction. The factor of cost ran through much of the discussion, and it was agreed that a college should not advertise honors courses merely to obtain students but that if the plan were adopted it should be honestly carried out. It was further agreed that individual professors could do, and are doing at times, a great deal to develop the

more promising student, and, by giving freely of their time, would not impose an additional burden on the finances of the college. Comprehensive examinations, the matter of variable credits, and the general question of how to help the gifted students were discussed in connection with the main topic.

The officers of the Tufts Branch for the present academic year are Professor A. W. Leighton, Chairman, and Professor F. N. Weaver, Secretary.

FREDERIC N. WEAVER,
Secretary.

COLLEGE NOTES

Carnegie Institute of Technology.—Beginning next fall couress in chemistry and in chemical engineering will be administered under two separate departments instead of one as at present. Thomas R. Alexander, associate professor of inorganic chemistry, will become acting head of the Department of Chemistry, and Warren L. McCabe, professor of chemical engineering, will head the Department of Chemical Engineering. The combined courses are now under the direction of J. H. James, who has served the institution since its founding in this capacity. Dr. James has been granted a leave of absence for next year, after which he will retire from teaching.

Dr. Alexander has been a member of the chemistry faculty since 1916 when he came to Tech from the University of Pennsylvania. He received the A.B. and M.A. degrees from Washington and Jefferson College, and the Ph.D. from the University of Pennsylvania. He served as instructor in chemistry at Penn before coming to Tech.

Dr. McCabe joined the faculty of the College of Engineering last fall as professor of chemical engineering. He did his undergraduate and graduate work at the University of Michigan, and was an associate professor at his alma mater before coming to Tech. He is widely known for his research on chemical engineering problems. Under his direction, a program of graduate study in chemical engineering has already been begun at Tech, and work in this field will be further expanded.

An **Electronics Institute,** consisting of a special lecture and conference program in electronics, will be held as a part of the 1937 Summer Session of the University of Michigan, with the coöperation of the General Electric Company, the Westinghouse Electric and Manufacturing Company, the Bell Telephone Laboratories, and the Radio Corporation of America.

The Institute lectures will be given by Saul Dushman and Lewi Tonks of the General Electric Research Laboratories, H. E. Mendenhall and F. B. Llewellyn of the Bell Telephone Laboratories, Joseph Slepian and R. C. Mason of the Westinghouse Research Laboratories, V. K. Zworykin and B. J. Thompson of the RCA Research Laboratories, L. B. Loeb of the University of California, and W. G. Dow of the University of Michigan.

The lecture program will consist of two independent four-weeks lecture sequences, dealing respectively with high-vacuum (June 28 to July 24) and gaseous-conduction (July 26 to Aug. 20) electronic

principles. In parallel problem laboratory and conference courses the lecture material will be worked into illustrative engineering problems, and teaching methods will be demonstrated and discussed. Opportunities for informal conferences will be provided.

Courses in various cognate branches of electrical engineering, physics, and mathematics will be included in the Institute program. Selection from among the various elements of the program will permit individual needs to be met.

The primary objective of the Electronics Institute will be to provide an opportunity for teachers and prospective teachers of electronics, also engineers and physicists engaged in electronic development work in industry, to broaden and unify their grasp of fundamental electronic principles. It is believed that this opportunity for association between electronics teachers and the men who have been and are the leaders in electronic research and development in industrial laboratories will help greatly to clarify methods and policies in the teaching of electronics in engineering schools.

A special bulletin describing the details of the Institute program is being prepared, and will be mailed to anyone interested on request. Address Professor W. G. Dow, Electrical Engineering Department, University of Michigan, Ann Arbor, Michigan.

Rensselaer Polytechnic Institute.—The faculty has adopted a new policy permitting students to select optional courses in the junior and senior years. Heretofore throughout Rensselaer's history there has been no deviation from courses as laid down and inflexibly required in the various departments.

The following have been appointed instructors: Stanley V. Best, in drawing in the civil engineering department; Allen King, in physics; James V. Murray, in chemistry; Stephen S. Stack, in the department of electrical engineering and physics. Mr. Murray will succeed Max O. Debacher, resigned to enter industry.

Promotions affecting nine faculty members were announced as follows effective in September: George Howard Carragan, from associate professor to professor, department of electrical engineering and physics; Stanley Bailie Wiltse, from associate professor to professor, department of electrical engineering and physics; Guy Merritt Phelps, from associate professor to professor, in charge of drawing courses; Harold Bartlett Howe, from assistant professor to associate professor for the drawing courses; Turpin Chambers Bannister, from instructor to assistant professor, department of architecture; William Herbert Rauscher, from instructor to assistant professor, department of chemical engineering and chemistry; Lynn L. Merrill, from instructor to assistant professor, department of mathematics; Dennis Burley Ames, from instructor to assistant professor, department of mathematics; Ralph Ernest Huston, from instructor to assistant professor, department of mathematics.

NEW MEMBERS

BAKMETEFF, BORIS A., Professor of Civil Engineering, Columbia University, New York City. F. L. Eidmann, G. R. Karelitz.

BARDSLEY, CLARENCE E., Professor of Hydraulic Engineering, Missouri School of Mines, Rolla, Mo. H. H. Armsby, I. H. Lovett.

BOSTON, ORLAN W., Professor and Director, Metal Processing, University of Michigan, Ann Arbor, Mich. (re-instatement).

CARTY, DONALD J., Professor of Speech, Manhattan College, New York City. Brother A. Leo, J. C. G. Seidl.

CORY, MERTON M., Professor of Electrical Engineering, Michigan State College, East Lansing, Mich. L. S. Foltz, H. B. Dirks.

DODD, CHARLES M., Professor of Ceramic Engineering, Missouri School of Mines, Rolla, Mo. H. H. Armsby, I. H. Lovett.

FELLOWS, JULIAN R., Associate in Mechanical Engineering, University of Illinois, Urbana, Ill. F. M. Porter, R. P. Hoelscher.

FULLER, WILLIAM J., Chairman, Engineering Department, Milwaukee Center, University of Wisconsin, Milwaukee, Wis. R. W. Fowler, B. G. Elliott.

GROSECLOSE, FRANK F., Associate Professor of Mechanical Engineering, University of North Carolina, Chapel Hill, N. C. E. G. Hoefer, E. W. Winkler.

HUFFMAN, HAROLD F., Professor of Electrical Engineering, Southern Methodist University, Dallas, Texas. J. M. Bird, Sophus Thompson.

HUSS, HARRY O., Instructor in Engineering, University of Toledo, Toledo, Ohio. D. M. Palmer, C. G. Brennecke.

LANDON, RANSOM D., Associate Professor of Civil Engineering, Southern Methodist University, Dallas, Texas. J. M. Bird, Sophus Thompson.

LIGHTBURN, FRANK E., Assistant Professor of Theoretical and Applied Mechanics, Iowa State College, Ames, Iowa. H. G. Gilkey, F. C. Dana.

MCCAFFERY, RICHARD S., Professor of Mining and Metallurgy, University of Wisconsin, Madison, Wis. J. F. Oesterle, G. L. Larson.

MEYER, CARL F., Exchange Professor of Engineering, University of Hawaii (Assistant Professor of Civil Engineering, Worcester Polytechnic Institute). E. A. Hoy, C. B. Andrews.

MINDLIN, RAYMOND D., Instructor in Civil Engineering, Columbia University, New York City. J. M. Garretts, J. K. Finch.

OWEN, RAY S., Associate Professor of Topographical Engineering, University of Wisconsin, Madison, Wis. J. M. Dorrans, B. G. Elliott.

PATTERSON, ROBERT A., Professor of Physics, Rensselaer Polytechnic Institute, Troy, N. Y. H. L. Dodge, F. L. Bishop.

POPE, LATHROP C., Tutor, Civil Engineering, College of the City of New York, New York City. Frederick Skene, E. B. Smith.

REINTJES, JOHN F., Instructor in Electrical Engineering, Manhattan College, New York City. Brother A. Leo, F. L. Bishop.

SCHOONOVER, REX H., Head, Engineering Mechanics, Wayne University, Detroit, Mich. A. R. Carr, D. E. Perkins, R. T. Northrup.

STEVENSON, BRENTON W., Assistant Professor of English, University of Toledo, Toledo, Ohio. S. A. Harbarger, H. W. Bibber.

TUDBURY, CHESTER A., Instructor in Electrical Engineering, Fenn College, Cleveland, Ohio. S. A. Harbarger, H. W. Bibber.

VIERCK, ROBERT K., Instructor in General Engineering Drawing, University of Illinois, Urbana, Ill. R. P. Hoelscher, H. H. Jordan.

VIVELL, ALLEN E., Instructor in Electrical Engineering, Princeton University, Princeton, N. J. Jos. C. Elgin, C. H. Willis.

WESKE, JOHN R., Assistant Professor of Aerodynamics, Case School of Applied Science, Cleveland, Ohio. H. W. Bibber, S. A. Harbarger.

WOOD, JOHN W., Head Master, Rindge Technical School, 367 Howard St., Cambridge, Mass. C. E. Tucker, H. B. Phillips.

Engineering Economy Page

The activities of the Committee on Engineering Economy in the first year of its existence have related chiefly to providing opportunities for the exchange of ideas in this somewhat controversial field of engineering instruction. A special problem regarding the promotion of discussions of general principles in this subject lies in the fact that people interested in it may have their major interests in almost any field of technology, and the common meeting-grounds are few. With the diversity of major interests represented in the S. P. E. E. membership this gives the various facilities of the S. P. E. E. an especially high value as a forum for such discussions.

The Committee has recognized that these facilities may be used in three ways: (1) through the conduct of a regular page in the Journal of Engineering Education (following the good example of the Divisions of Drawing and English); (2) through joint conferences at the annual meeting of the Society; and (3) through occasional summer schools in economics of engineering, preferably held in proximity to the annual meeting, in which engineering economy is one of the several subjects of discussion.

This is the first of the Engineering Economy Pages. Subsequent ones will be under the editorship of Professor Edmund D. Ayres of the University of Wisconsin. This page will permit frequent brief discussions on the many unsettled problems of teaching in this field; in addition it may serve as the successor of the Clearing House of Engineering Economics, which was carried on for many years under the direction of Professor J. C. L. Fish of Stanford, in making problem material developed by one teacher available to others. By providing an opportunity for their publication it is hoped that this page may stimulate the compilation of periodical references; a special problem for instructors in this subject is created by the fact that material on specific problems of technical economy is not indexed—under "economy" or any similar title—in any periodical index. Any one interested in contributing to this page or in making suggestions as to what it should contain, is invited to communicate with Professor Ayres.

The second type of opportunity mentioned for the exchange of ideas on engineering economy—a joint conference at the annual meeting—has been arranged as part of the Cambridge program. The division or committees representing the six major professional fields of engineering are coöperating in this conference, with one speaker on the program from each coöperating group. Papers will be presented by representatives of mining, civil, chemical, and electrical engineering with discussion led by representatives of mechanical and industrial engineering.

The third type mentioned—the summer school—has also been arranged for this year. Detailed announcement of the program at Stevens Engineering Camp from June 18 to 26 has been made elsewhere. It should be recognized that such meetings as this allow much more time in their formal sessions for discussion of teaching methods and subject matter than can possibly be obtained at the annual meetings of the Society. In addition—particularly under the favorable conditions obtaining at Stevens Camp—they provide excellent opportunity for that informal out-of-hour discussion which can be expected to play an important part in the advancement of this developing field of engineering instruction.

Eugene L. Grant,
Chairman.

The T-SQUARE PAGE

DEVOTED TO THE INTERESTS OF THE DIVISION OF ENGINEERING DRAWING

FRANK A. HEACOCK, EDITOR

IMPORTANT INFORMATION
NATIONAL DRAWING COMPETITION 1936–1937

Auspices of the Drawing Division S. P. E. E.

1. Each submitted drawing must be accompanied by a statement concerning the following information:
   a. The competition class in which the drawing is to be entered;
   b. The name, address, and institution of the drawing teachers;
   c. The number and length of lecture or class periods, the number and length of drawing room periods, and the number of "home work" periods which were available to the student prior to and including the time spent on the submitted drawing;
   d. The number of units, semester hours credit or yearly credit, of mechanical drawing earned by the student competitor before entering college;
   e. The name and address of the student whose drawing is submitted.

   Put the above information in envelope and attach to the drawing. On outside of envelope give Entry Number and Class in which the drawing is entered.
2. Pack drawings FLAT and wrap carefully so that they will arrive in perfect condition.
3. Make necessary arrangements for the return of the drawings after the competition, including carriage charges (postage or express).
4. Send drawings to arrive in Cambridge, Mass., not later than June 26, 1937. However, drawings should be sent as soon as completed and well in advance of above date.
5. Send drawings addressed to:

   Professor Earle F. Watts,
   S. P. E. E. Drawing Competition,
   Drawing Dept., Room 2–351,
   Massachusetts Institute of Technology,
   Cambridge, Mass.

ENGLISH NOTES

DEVOTED TO THE INTERESTS OF TEACHERS OF ENGLISH IN ENGINEERING SCHOOLS

J. L. VAUGHAN, EDITOR

The Conference on English to be held in connection with the annual convention of the Society at Cambridge should be both important and interesting. At the 1936 meeting of the Society the Council authorized an investigation of instruction in English in the engineering colleges of the country, and it now appears that a sum sufficient to meet the necessary expenses will be available. In order that the investigation might have weight, a number of prominent engineers and executives in engineering colleges were appointed to the Committee, with President Elliott of Purdue University as chairman. Preliminary work on a program of investigation is already under way, and a detailed plan will be submitted for discussion at one of the sessions. It is hoped that many persons interested in English in technical institutions will be present at the meeting and will contribute suggestions and criticisms. The questions which are being asked by both engineering teachers and teachers of English show that there is much to be learned and to be done. Articles on English in engineering journals show an increasing sense of the importance of the subject, but many of them also show disappointment that the results of our instruction are not better. The investigation should make clear not only the great variety of problems involved but also the best methods of solving the problems.

The other sessions should be equally valuable. One session will be devoted to the work in English at the Massachusetts Institute of Technology. The excellence of this work is so generally recognized that this meeting alone would justify a large attendance on the part of teachers of English. At another session there will be a detailed report of an experiment in coöperation between the Department of English and the Department of Electrical Engineering at Iowa State College. Since it concerns one of our most important problems as handled in an institution recognized for its alertness in all that concerns instruction in English, it will attract wide interest. In addition, there will be a report on "English Notes" in the JOURNAL, a section inaugurated last year. Professor Vaughan has already made this an important part of the work of the Committee on English. His review of what has already been done and his suggestions for the future will be interesting and should stimulate encouragement and active coöperation.

H. L. CREEK.

NECROLOGY

DUDLEY PEAK CRAIG

"Dudley Peak Craig was born in Ghent, Kentucky, on November 8, 1890. He graduated from Purdue University in 1912 and for nine years after graduation he was connected with the Western Electric Company in Chicago and with the Firestone Tire and Rubber Company in Akron, Ohio. He was appointed instructor at Purdue University in 1921, was promoted to assistant professorship in 1925 and to associate professorship in 1931. In September, 1936, he accepted the professorship of Mechanical Engineering at the Colorado State College.

"Professor Craig is author of several articles on power plants as well as co-author of a book on Power Plant Engineering.

"At Purdue University Professor Craig was very popular with his students and highly respected by his colleagues for his integrity, thoroughness and inspirational value as a teacher."—**A. A. Potter.**

"Professor Craig came to Fort Collins, Colorado, in August 1936, to take over the duties of Professor of Mechanical Engineering and Head of the Department at Colorado State College upon the retirement of Professor L. D. Crain. He became active on the Campus, in the Colorado Local Section of the American Society of Mechanical Engineers, and in the Colorado-Wyoming Section of S. P. E. E. At the Section meeting at Laramie, Wyo., in November, Professor Craig was elected Secretary of the Section for the coming year. While his residence in our locality was brief, he had already gained the admiration, respect and friendship of a host of his fellow engineers, and the loss of his talents will be distinctly felt by our profession."—**Roscoe W. Morton.**

O. P. HOOD

O. P. Hood, 71 years of age, until recently chief of the technological branch of the U. S. Bureau of Mines, died April 22, 1937, at his residence, 1831 Irving Street, after a long illness. Dr. Hood was retired June 30, 1936, after his term of office had been extended one year beyond the age limit by executive order. Before coming to Washington, Dr. Hood served with the Bureau of Mines at Pittsburgh as chief mechanical engineer.

Prior to joining the staff of the Bureau of Mines, he was Professor of Mechanical and Electrical Engineering at the Michigan

College of Mines for a period of thirteen years. From 1889 to 1898, he was Professor of Engineering at the Kansas State Agricultural College.

Dr. Hood was an honorary member of the American Society of Mechanical Engineers, of the American Institute of Mining and Metallurgical Engineers, of the American Society of Heating and Ventilating Engineers, and of the International Railway Fuel Association. He was a member of the Washington Society of Engineers and of the Society for the Promotion of Engineering Education.

Dr. Hood was born in Lowell, Mass., June 14, 1865. He was a member of the class of 1885 of the Worcester Polytechnic Institute and graduated from the Rose Polytechnic Institute in 1885. He was elected to Tau Beta Pi and held the degree of Doctor of Engineering from the latter institution.

BOOK REVIEWS

Elementary Surveying. WILLIAM HORACE RAYNER, C.E., M.S., Assistant Professor of Civil Engineering, University of Illinois. D. Van Nostrand Co., Inc., New York. 16 Ch., 380 pp.

Professor Rayner is another author to offer an Elementary Surveying textbook. This text is suitable for a short course in surveying. It is also suitable for a long course or a more advanced course in cases where the instructor wishes a text stressing the fundamental principles of surveying. The instructor may supplement the text with material pertaining particularly to his own course.

The text may also be used as a field and office manual for those courses that consist of a series of exercises. In the field and office problems associated with the different chapters, the author has taken pains to explain fully the problem. In the field problems, using one as an example, he explains the object, equipment, complete procedure, and checks.

Large print and good illustrations are contained in the makeup of this text. The logarithmic tables are to five places. Tables for use in field astronomy, stadia, and circular curve work are also a part of this book.

W. IRWIN SHORT.

Heating, Ventilating, and Air Conditioning. ARTHUR M. GREENE, JR. John Wiley & Sons, Inc., Publishers. New York. 446 pp. $4.50.

The author of this text presents a very complete analysis of the subject from both the theoretical and practical viewpoint. Special emphasis is placed on winter air conditioning, and the various types of heating systems and accessories are dealt with in detail.

Among the various topics, the text presents the following essential, fundamental information on the subject: properties of air, heat transmission through walls, radiators, controls, etc. One chapter deals specifically with district heating. In addition each chapter is supplemented with a list of problems.

F. H. STIENING.

Reinforced Concrete Construction, Volume I. GEORGE A. HOOL. Revised by HARRY E. PULVER. McGraw-Hill Book Co., Inc.

"Reinforced Concrete Construction," Volume I, by George A. Hool, has been a recognized leading textbook on this subject since

1912. Harry E. Pulver, Professor of Civil Engineering at the University of Wisconsin, has rewritten and rearranged this text. The material has been revised to conform with the 1936 recommendations of the American Concrete Institute. The revised regulations for floor slabs with supports on sides is explained in detail. The effects of shrinkage and plastic flow on various structural members is discussed, particular attention being given to concrete columns. The chapter on bending and direct stress has been extended to include circular as well as rectangular sections. The tables and diagrams have been revised and extended so as to care for the higher concrete stresses now in use.

This revised text should meet with considerable favor among its old friends.

A. DIEFENDORF.

Theory of Modern Steel Structures, Volume II. LINTON G. GRINTER. Macmillan Co., New York.

The second volume of this series treats the analysis of statically determinate space frames and the analysis of nearly all common types. Although the text covers the more important theories of analysis and presents numerous applications to particular structures, no attempt is made to exhaust the subject. The text treats suspension bridges, building frames, arches, etc. These structures are used mainly to illustrate the wide usefulness of virtual work, balancing moments, column analogy, and the other important tools of analysis.

A. DIEFENDORF.

Applications of the Method of Symmetrical Components. WALDO V. LYON. McGraw-Hill Book Co., Inc. 579 pages. $6.00.

The method of resolving an unbalanced system of coördinate vectors into a number of balanced systems, which may be solved by familiar methods, has added a powerful tool to the engineer's equipment. This method, known as The Method of Symmetrical Components, has proved to be of great value in the analysis of unsymmetrical circuits. Although the Method of Symmetrical Components was devised for the specific purpose of analyzing rotating machines, it is probably more widely used in determining the conditions set up by unsymmetrical faults on power networks.

Applications of The Method of Symmetrical Components, by Waldo V. Lyon, begins with an historical outline and development of the principles of Symmetrical Components and proceeds in regular order through static circuits, transmission lines, trans-

formers, induction machines, synchronous machines, and power networks. About forty-five numerical illustrations are given indicating how the method may be applied to typical concrete cases.

This book is an excellent one and should be welcomed by graduate electrical students.

JAMES A. WASMUND.

Electricity and Magnetism. A. W. HIRST. Prentice-Hall, Incorporated. 388 pages. $4.50.

"Electricity and Magnetism," by A. W. Hirst, contains considerably more than is usually covered in an introductory textbook of similar title. This book is built on a firm and well-balanced foundation of elementary scientific principles, treated in such a manner as to give them life and reality to the student. This is done by giving a large number of practical illustrations of actual application. Another feature of the text is the large selection of problems offered the student in order that he may become familiar with the methods of solution. The answers to these problems are given, and the accuracy of any solution may be checked. A large number of worked examples appear throughout the book.

In addition to the chapters allotted to electric and magnetic circuits, the author has included chapters on, Measuring Instruments; Alternating Currents; Direct and Alternating Current Machinery; and Electrostatics.

The large number of cross-references make "Electricity and Magnetism" a valuable reference and a welcome addition to any technical library.

JAMES A. WASMUND.

G-E *Campus News*

"EXPERIMENTALLY—NOT ON PAPER"

SIXTEEN years or so ago, Dr. Willis R. Whitney, now Vice President in charge of General Electric research, sent a note to a research worker, suggesting experiments with a motor-generator set sealed gastight and filled with hydrogen to see if the machine ran cooler, and more efficiently. The results of those experiments promoted the use of hydrogen in synchronous condensers and established the present trend toward the use of hydrogen in turbine-generators.

Windage loss in a rotating machine is reduced about 90 per cent and noise is greatly decreased because of the low density of hydrogen. Heat is carried away much more rapidly through the higher thermal conductivity of hydrogen. Resistance to damage due to corona within the machine is increased. These characteristics increase the electrical output for a given core size and reduce inspection and maintenance expense.

The construction of several hydrogen-cooled turbine-generating units is now going on in the Schenectady turbine shop—perhaps all because of that note written by Dr. Whitney so many years ago.

FOR OUTSTANDING ACHIEVEMENT

FEBRUARY 26 was a big day in the lives of thirty-three G-E employees. These thirty-three were selected from the 60,000 persons in the Company's employ to receive the Charles A. Coffin Awards. There were fifteen factory men, twelve engineers, two commercial men, and four administrative and clerical employees. Twelve of the group are college graduates:

Roy T. Adolphson, University of Washington, '34; Eugene W. Boehne, Texas A & M, '26 and M. I. T., '28; Claude P. Hamilton, University of Nevada, '14; George H. Jump, Syracuse U., '10; Jack R. Meador, Texas A & M, '27 and '28; Harry E. Scarbrough, Georgia Tech., '19; Edward J. Schaefer, Johns Hopkins, '23; Alfred A. Thompson, University of California, '05; Carl Thumin, College of City of New York, '17, M. I. T., '20; Harold E. Trekell, Kansas State, '31; Elmer J. Wade, University of Maine, '19; and Leo F. Worden, West Virginia University, '25.

Each year General Electric makes these awards to employees who have done outstanding work, as provided in the Charles A. Coffin Foundation established in 1922. Charles A. Coffin was organizer and first president of General Electric.

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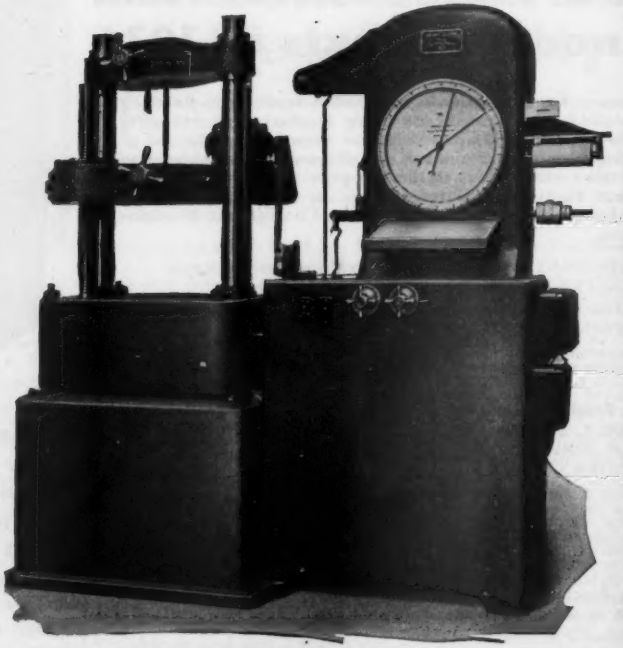

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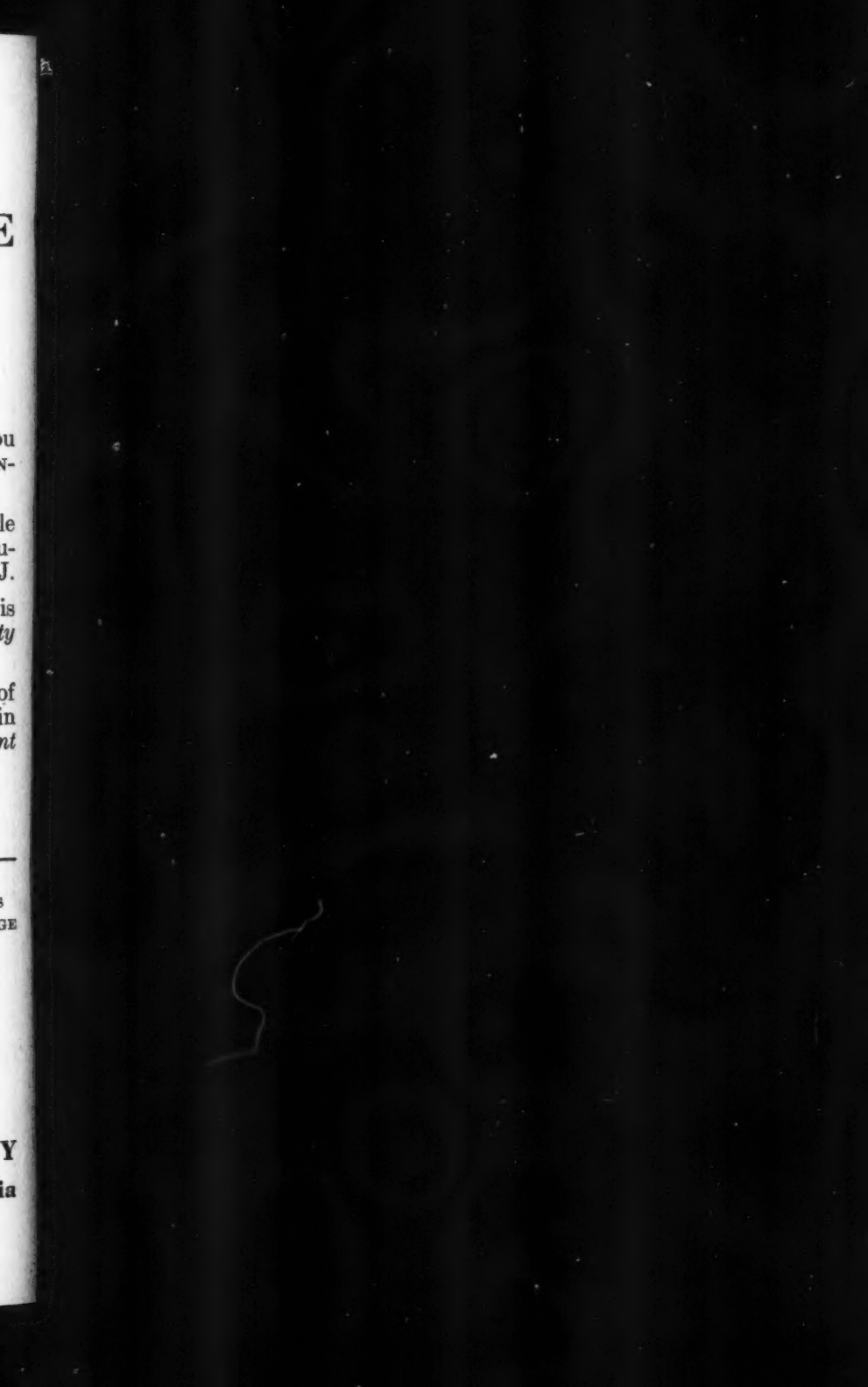
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